306.8
Am3

LIBRARY
RECEIVED
FEB 14 1938
Department of Agriculture

AMERICAN
DYESTUFF REPORTER

DEVOTED TO THE INTERESTS OF TEXTILE CHEMISTRY
BLEACHING ◆ DYEING ◆ FINISHING ◆ PRINTING

VOLUME 27 FEBRUARY 7, 1938 NUMBER 3

Where SUPERLATIVE FASTNESS
TO WASHING IS ESSENTIAL

Du Pont suggests...

PONTAMINE* DIAZO ORANGE RFW
PONTAMINE DIAZO SCARLET FW
PONTAMINE DIAZO SCARLET GFW
PONTAMINE DIAZO RED BFW

SUITABLE for use on wash-fast cotton, rayon and silk fabrics, these developed dyestuffs are in a class by themselves by virtue of their *outstanding fastness to washing.*

Recently introduced by du Pont, they form the nucleus of a group of wash-fast colors which will be added to as research and experimentation develop new and improved products of this type.

Washing exerts but a negligible effect upon the dyed shade, and there is no danger of bleeding during laundering or wet processing. They discharge satisfactorily and may, therefore, be employed as grounds for vat and other prints.

In other respects, these products level and penetrate well and possess fastness properties that meet trade requirements.

DU PONT DYESTUFFS

*REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & COMPANY, INCORPORATED
ORGANIC CHEMICALS DEPARTMENT
DYESTUFFS DIVISION WILMINGTON, DELAWARE, U. S. A.
BRANCH OFFICES: Boston, Mass. Charlotte, N. C. Chicago, Ill. Philadelphia, Pa. Providence, R. I. New York, N. Y. San Francisco, Calif.

OFFICIAL PUBLICATION OF THE AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

If you are tempted...

DON'T!

AT recent sales of *used* textile finishing machinery in New England, prices equalling *60 to 70%* of new modernly designed machines were paid.

Does This Pay?

Second-hand machinery has worn parts and replacements are always EXPENSIVE.

Second-hand equipment is always uncertain. Motor re-winding, for instance, is EXPENSIVE.

Taking down, removal and re-erection of second-hand machinery is *EXPENSIVE.*

Above are but a few of the expensive dangers of buying second-hand machinery. And then what have you—equipment which obviously must be behind the times, for we are constantly engaged in re-designing our standard line of finishing machinery—anti-friction bearings, lighter yet stronger metals, and higher speeds are features of these new machines which finish goods better and at lower prices.

It is because of the problems which have been put up to us by concerns that *ONCE* thought it economical to buy second-hand machinery that we say

If You Are Tempted—DON'T

DID you receive our new catalog? If you did not, let us know. Your copy is ready for mailing.

H. W. BUTTERWORTH & SONS CO.

PHILADELPHIA, PA.

Established 1820

PLANTS at PHILADELPHIA and BETHAYRES, PA.

New England Office:
TURK'S HEAD BUILDING
Providence, R. I.

Southern Office:
JOHNSTON BUILDING
Charlotte, N. C.

In Canada:
W. J. WESTAWAY CO.
Hamilton, Ontario

BUTTERWORTH *finishing* MACHINERY

A COMPLETE LINE OF FINISHING AND RAYON MACHINERY FOR THE TEXTILE INDUSTR

A. P. HOWES
Publisher

M. D. REESER
Advertising Manager

AMERICAN DYESTUFF REPORTER

LOUIS A. OLNEY
Directing Editor

NORMAN A. JOHNSON
Managing Editor

Copyrighted 1938 by Howes Publishing Co.

DEVOTED TO THE INTERESTS OF TEXTILE CHEMISTRY
• BLEACHING • DYEING • FINISHING • PRINTING •
AND THE NECESSARY MECHANICAL EQUIPMENT

"Circulated Everywhere Textiles Are Processed"

Subscription Price: $5.00 per year; Canadian, $6.00; Foreign, $6.00. Fifty cents per copy

VOLUME 27 | FEBRUARY 7, 1938 | NUMBER 3

CONTENTS OF THIS ISSUE

Contents of previous issues can be found by consulting the Industrial Arts Index at your library

General

Washington News Letter 59
Waldon Fawcett

Trade Notes—New Products 85

Proceedings of
American Association of Textile Chemists and Colorists

Seventeenth Annual Meeting:

Annual Business Meeting P61

The Quantitative Measurement of Stiffness and Resiliency P65
Erwin J. Saxl

Suggestive Observations on the Wetting, Mercerization and Dyeing of Cellulose
Part I P70
Charles F. Goldthwait

Part II P76
Charles F. Goldthwait and Earl R. McLean

Recent Trends in Textile Technology P78
Edward R. Schwarz

Meeting, Philadelphia Section P84

Color Council Meeting P84

Applicants for Membership P84

Calendar of Coming Events P84

Official Publication of the American Association of Textile Chemists and Colorists

THE OBJECTS OF THIS ASSOCIATION ARE:

"To promote increase of knowledge of the application of dyes and chemicals in the Textile Industry.

"To encourage in any practicable way research work on chemical processes and materials of importance to the Textile Industry.

"To establish for the members channels by which the interchange of professional knowledge among them may be increased."

Published Every Other Monday

HOWES PUBLISHING CO. ~ ~ 440 FOURTH AVE. ~ ~ NEW YORK

CLOSING DATE FOR ADVERTISING COPY: MONDAY PRECEDING ISSUANCE DATE

NATIONAL

FORMULAS FOR THE OFFICIAL COLORS

NEW YORK WORLD'S FAIR · 1939

Unusual attention is being given by the New York World's Fair 1939 to the color combinations and shades of displays and exhibits. The National Aniline & Chemical Co., Inc. has developed formulas to match these official New York World's Fair shades on the usual textile fibres. Stocks of required dyes and formulas are available through your nearest branch. Samples of your undyed materials may be submitted for individual matching formulas.

"WE INVITE YOUR COLOR PROBLEMS"

NATIONAL ANILINE & CHEMICAL CO., Inc.

40 RECTOR STREET **NEW YORK, N. Y.**

BOSTON	150 Causeway St.	CHARLOTTE	201-203 W. First St.
PROVIDENCE	15 Westminster St.	GREENSBORO	Jefferson Standard Bldg.
CHICAGO	357 W. Erie St.	ATLANTA	140 Peachtree St.
PHILADELPHIA	200-204 S. Front St.	CHATTANOOGA	James Bldg.
SAN FRANCISCO	517 Howard St.	PORTLAND, ORE.	646 N. Thompson St.
TORONTO	137-145 Wellington St., West		

BRANCHES AND DISTRIBUTORS THROUGHOUT THE WORLD

NATIONAL DYES

AMERICAN
DYESTUFF REPORTER

VOLUME 27 FEBRUARY 7, 1938 NUMBER 3

Washington News Letter

WALDON FAWCETT

THE forces of technical research,—the textile chemistry contingent, no less than others—may not have realized what a stake they hold in the precipitation at Washington of the political issue of restriction or repression of so-called "monopolies" in business. To be sure, the item of research, as such, has not been specified in the informal indictments drawn by spokesmen of the present Administration. But, to apprehend ultimate approaches in this quarter one has only to note the mounting prejudice of the agitators directed against aggregations of patents in strong hands.

In the larger aspect, though, the threat in the current gesture arises from the fact that the main support for explorative technical research on a large scale has been supplied by the integrated business interests now under critical fire. Hence the possibility of disruption of policies by any disturbance of corporate structures or curtailment of corporate or cooperative activities. One hopeful sign at the moment is found in the opportunity likely to be afforded at Congressional Hearings to emphasize the value of the research made possible by concentrations of capital.

SUMMONS TO MISUSERS OF "DYED"

The Federal Trade Commission continues unabated the vigilance already noted in this correspondence against omission or misuse of the word "dyed" or equivalent expressions. This police work has turned, more recently, upon offenders in the fur trade and Cease and Desist Orders have been issued against Fox-Weis Company of Philadelphia and other distributors of furs and fur coats.

Practices complained of involve, for the most part, the sale of garments made from dyed muskrat or dyed coney which are offered to the public under designations in which the word "Seal" is prominent. In some instances dyed coney and muskrat furs resembling seal have been advertised without qualification of any kind. In other instances the explanatory phrase "dyed coney" or "dyed muskrat" has been introduced but in type so small or with such separation from the seal designations that the effect has been lost upon the average layman. To cure this unfair method of competition the Trade Commission is putting out Orders which require that in instances where a fur has been dyed in imitation of another fur, names containing the word seal must be compounded with the word "dyed" and such words as compounded must be immediately followed by the true name of the fur such as "Hudson Seal-Dyed Muskrat".

COOPERATION IN COLOR NOMENCLATURE

With definite progress attained in the project for a new system of naming colors, curiosity is shown by bystanders as to the form of this concerted effort to provide accurate measurements of color strength and tone. In explanation it may be said that the program centering at Washington is a cooperative undertaking between the American Pharmaceutical Association, the Inter-Society Color Council, and the National Bureau of Standards. The Government Bureau has undertaken to study the plan proposed by the Inter-Society Color Council at the insistence of the American Pharmaceutical Association and to supply the colorimetric information.

Of moment at this juncture is the announcement that the final selection and adoption of the boundaries between the various colors rests with the Council and will not be definitely fixed for perhaps another year. Many details remain to be threshed out at meetings of the Council which are open to all individual members. While the immediate project is designed to provide exact, scientific description of colors for the pharmacist in his task of compounding drugs and medicines, the suggestion has been made that ultimately it will afford a way out of the maze of miscellaneous color names which now cause confusion in the industries, arts and sciences.

A reduction from the contemplated minimum of 500 color names to a new low of 320 color names is the latest promise of the cooperative program. The division of the color solid into 320 compartments is counted upon to supply an adequate vocabulary of color names having definite logical and scientific basis,—a system which would attain authoritative legal standing yet would, at the same time, yield a concentrated glossary of simple color names no less descriptive than those now in use. With coverage to be provided for thousands of distinguishable colors, producible by dyes and pigments, it is, of course, obvious that each of the 320 key names in prospect must indicate a given color range rather than a particular expression.

The reaction of color chemists to the project now in hand has, with the passing of time, been shown to be

predicated largely upon the assurances of adequate basic foundations for the emerging system. This may explain the emphasis given latterly to the circumstance that the system is scientifically founded on material color standards deposited at the National Bureau of Standards,—standards which have themselves been fundamentally measured. Frequent quotation has been made of the comment of the specialist at the Bureau who observed: "Although nominally based upon the Munsell Book of Color, the actual base is fundamental and independent of the integrity of any material sample. In case of disputes as to which color name applies to a given sample, it would be possible for the National Bureau of Standards or for any laboratory well equipped for color measurements to make the determination as accurately as may be necessary".

For concrete results of the project that had its beginnings fully fifteen years ago, colorists await the publication in an early number of the Journal of the American Pharmaceutical Association of detailed descriptions of the proposed color names. Upon this showing judgment may be passed as to whether the tentative names live up to the promise of aptness, simplicity and descriptive value and a verdict rendered upon the force of the argument that a long step in progress has been made in the elimination of qualifying or modifying suffixes which attach "ish" or similar endings to definite color names often to the eternal confusion or mystification of laymen who find in the added syllable no clue to color depth, strength or brilliancy.

COLOR IN INFORMATIVE LABELING

Almost from the inception, in its present form and proportions, of the current program of consumer-retailer relations it has been a fair assumption that color interests must ultimately recognize their participating interest in the institution known as informative labeling or descriptive labeling. The nature and extent of the contact has been emphasized by the rapid expansion of the movement for specification for laymen. Yet more recently the presence of a controversial element has been attested by the debate over the division of responsibility for labeling as between manufacturers and distributors.

What, in some opinions, most definitely concerns dyestuff and textile chemistry interests is the set-up of label itemization as it affects color. Just what information with respect to color and color-qualities is to be given to curious consumers is of moment in any event. It takes on additional significance, though, with moves to bring about, if practicable, some degree of standardization in the labeling.

In view of the sharp divergence of views in industrial and commercial circles with regard to the entire proposition of informative labeling, it is perhaps just as well that the suggestion for uniformity in label layout is finding most support in outside and supposedly neutral quarters. For example, the Division of Codes and Specifications of the National Bureau of Standards has taken occasion to point out the advantage of a model label pattern which shows the guaranteed compliance of the labeled commodity with the requirements of a designated nationally-recognized specification or standard. The set formula calls not only for designation of the commercial standard or specification but also for identification of the firm or agency holding itself responsible for the guarantee—a point of especial importance in respect to color.

The more conservative Federal specialists incline to the belief that uniformity in informative labeling will come only after the general public has been educated to the many technicalities involved in the products which are purchased. Set over against any impulses to standardization of label forms is the counter trend supplied by the disposition on the part of not a few labelers in the textile industries to present factual information calculated to encourage consumers to make a very definite comparison of values as between the labeled article and competitive products. Color claims especially lend themselves to this technique as against arbitrary grading under "A," "B," and "C" classifications.

FOOD COLOR INDUSTRY NOT STATIC

Statisticians at Washington are ready to vigorously take issue with critics who find no evidence of advancement, latterly, in the food color industry. The pessimism seems to have been induced by the fact that the number of firms engaged in color certification in 1937 showed no increase over 1936 and was but half the number similarly engaged in 1929. If the number of producers does not increase, however, the contrary is true of the volume of production. The total amount of straight dyes certified this past year was, by upward of 124,000 pounds, greater than has ever before been certified in any fiscal year. The total number of pounds of repacked material was likewise the highest in the history of color-certification work. The total of mixtures topped the aggregate in any recent year but did not equal the records established in 1925 and 1927.

SPECIFICATIONS FOR PYROXYLIN-IMPREGNATED FABRICS

The Government has been provided with specifications to cover five different grades of pyroxylin-impregnated fabrics. And thereby hangs quite a tale of research and experiment at the U. S. Government Printing Office. This undertaking was prompted by a desire to provide pyroxylin-impregnated fabrics which would supplant starch-filled book cloths at the world's largest printing plant and book bindery. New grades of impregnated fabrics were required to meet needs and conditions not contemplated in the case of the earlier pyroxylin-coated fabrics.

Faults to be overcome were on two counts. The excessively-heavy pyroxylin surface of some of the earlier coated fabrics made them subject to cracking and flaking wherever sharp bends occurred. On the other hand, starch-filled fabrics were deficient for the Governmental purposes in not being waterproof nor vermin proof. The new specifications indicate only partial disparity between impregnated

(Concluded on page 85)

PROCEEDINGS OF THE
American Association of Textile Chemists and Colorists

FEBRUARY 7, 1938

Officers of the Association

ALBAN EAVENSON, *President*
Eavenson & Levering Co., Camden, N. J.

DUNCAN FERGUSON—ARTHUR R. THOMPSON, JR., *Vice-Presidents*

WILLIAM R. MOORHOUSE, *Treasurer*
National Aniline & Chemical Co., Boston, Mass.

HAROLD C. CHAPIN, *Secretary*
Lowell Textile Institute, Lowell, Mass.

LOUIS A. OLNEY
President Emeritus and Chairman of the Research Committee
Lowell Textile Institute, Lowell, Mass.

Councilors-at-Large

BERKELEY L. HATHORNE
G. R. KREMERS
WALTER M. SCOTT
HAROLD M. CHASE
ARTHUR E. HIRST
HAROLD DE WITT SMITH

Councilors Representing Sections

BEN VERITY (Rhode Island)
HANS MEYER (New York)
ROLAND E. DERBY (N. New England)
C. A. JONES (South Eastern)
R. M. RITTER (Philadelphia)
ELMER F. SMITH (Midwest)
R. S. WHEELER (South Central)
THOMAS R. SMITH (Piedmont)

Local Sections and Their Officers

Northern New England Section
Carl Z. Draves, Chairman, Ludlow Mfg. & Sales Co., Ludlow, Mass.
John N. Dalton, Secretary, Pacific Mills, Worsted Division, Lawrence, Mass.

Rhode Island Section
Richard Haworth, Chairman, 25 Fountain St., Providence, R. I.
Raymond A. Pingree, Secretary, 7 Sayles Ave., Saylesville, R. I.

New York Section
George L. Baxter, Chairman, Bradford Dyeing Association, 40 Worth St., New York, N. Y.
P. J. Kennedy, Secretary, E. I. duPont de Nemours & Co., Inc. 61 Thomas St., New York, N. Y.

Philadelphia Section
Herbert S. Travis, Chairman, Rohm & Haas Co., Inc., 222 West Washington Square, Philadelphia, Pa.
Paul L. Speakman, 1506 Delaware Ave., Wilmington, Del.

Piedmont Section
Raphael E. Rupp, Chairman, Pacific Mills, Lyman, S. C.
J. W. Ivey, Secretary, Mathieson Alkali Works, Inc., Charlotte, N. C.

South Central Section
Walter E. Hadley, Chairman, Standard Coosa Thatcher Co., Chattanooga, Tenn.
Murray B. Smith, Secretary, 2404 Union Ave., Chattanooga, Tenn.

Midwest Section
Edward J. Siegrist, Chairman, Holeproof Hosiery Co., Milwaukee, Wis.
Herbert W. Tetzlaff, Secretary, Geigy Co., Inc., Milwaukee, Wis.

South-Eastern Section
E. A. Feimster, Jr., Chairman, Eagle & Phenix Mills, Columbus, Ga.
Alfred R. Macormac, Secretary, Alabama Polytechnic Institute, Auburn, Ala.

Lowell Textile Institute Student Section
Lee Gale Johnson, Chairman; Hugh Francis Carroll, Secretary.

North Carolina State College Student Section
A. E. Shumate, Chairman; J. W. Furr, Secretary

Philadelphia Textile School Student Section
Wayne F. Fry, Chairman; Robert Roecker, Secretary

Members should notify **Secretary** immediately of all address changes

Annual Business Meeting*

Saturday, December 4, 1937

The Session convened at twelve-thirty o'clock, President Cady presiding.

President Cady: The meeting will please come to order. I will ask the Secretary to present his Annual Report.

. . . Secretary Chapin then presented his prepared report. . . .

SECRETARY'S REPORT

For the past four years our Association has enjoyed a regular annual increase in membership, well distributed over all its Sections. From 1,259 members on Nov. 1, 1933, we have increased to 2,083 on Nov. 1, 1937; 65 per cent in four years. The gain of 355 members in the last year is the largest in our history.

What the year 1938 will bring it is impossible to foresee. Renewal dues received in November nearly equal those of last November. Membership applications more than offset the difference. We are thus some four per cent ahead, instead of the twenty per cent which we might expect on the basis of the intervening increase in membership. Early returns from Corporate and Sustaining memberships are well ahead of last year.

Although the profitable employment of its members is

*Philadelphia, Pa.

not among the stated objects of the Association, the connection between such employment and the health of the organization is too obvious to be neglected. In its stated object of providing channels by which interchange of professional knowledge may be increased, the Association lessens the chance that individual knowledge and ability may long remain unknown and unemployed. Through its Unemployment Register in the AMERICAN DYESTUFF REPORTER it provides opportunity without expense, for any unemployed member to bring his special talents to the attention of our entire membership, and many readers elsewhere. Our unemployed members are cordially urged to use this service.

Following are comparative membership figures for the various Sections in the past four years, and a list of Council meetings held since the last Annual Meeting:

November 1	1934	1935	1936	1937
Northern New England	247	273	284	312
Rhode Island	189	210	225	286
New York	316	363	381	448
Philadelphia	204	264	285	351
Piedmont	111	174	220	258
South Central	39	45	45	50
South East	38	48	50	75
Mid West	100	108	136	156
Student Sections	22	33	18	56
Unclassified	33	47	56	61
Corporate	25	28	28	30
Totals	1,324	1,593	1,728	2,083

Council Meetings

111th—Boston, February 5, 1937.
112th—Greensboro, April 17.
113th—New York, June 11.
114th—Boston, October 15.
115th—Philadelphia, December 3.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary.*

President Cady: Gentlemen, does anyone wish to ask any questions of the Secretary?

If not, I will direct that the report be accepted and placed on file.

We will now hear from the Treasurer, Mr. Moorhouse. . . . Treasurer Moorhouse then presented his report. . . .

TREASURER'S REPORT

(See auditor's report on next page)

President Cady: You have heard the report of the Treasurer. Does anyone have any questions he wishes to ask?

Mr. Thompson: I would like to ask if that $5,000 we were ahead last year and another $6,000 we are ahead this year—means that we are ahead $11,000 now?

Treasurer Moorhouse: Yes, that is true. Some of it might be earmarked, though. Some of that is Textile Foundation money that is really earmarked money, but ending the fiscal year, last year we had $5,000 more than receipts, and this year $6,000 more.

Mr. Thompson: Is that $6,000 added to the $5,000?

Treasurer Moorhouse: That is right.

President Cady: If there is no further discussion, I will direct that the report be received and filed.

By vote of the Council at its next to the last meeting, the Chair was instructed to have the accounts of both the Secretary and Treasurer audited by a public accountant. We arranged to have this work done by Price, Waterhouse & Co., and I have their audit here. I won't attempt to read it through, but it winds up thus: "In our opinion, subject to the foregoing remarks, the attached statement, together with the supporting schedule, fairly present a summary of the recorded receipts and disbursements of the American Association of Textile Chemists & Colorists for the year ending October 31, 1937 and the balances of cash in banks as of the close of the period under review." Signed, "Price, Waterhouse & Co."

(See auditor's report on next page).

I will ask Professor Olney if he has any report to make for the Year Book Committee.

REPORT OF YEAR BOOK COMMITTEE

Dr. Olney: I think this book (holding it up) is the report. The committee hopes that you are pleased with it. We have completely revised the whole system of arrangement this year. We believe, ourselves, that it is more convenient and more definite. It is the largest book we have ever put out, and at the same time we believe the quality of it, as far as material is concerned and also mechanical workmanship, is ahead of anything that we have presented before. I believe that is the best report I can make for the Year Book Committee.

I might add that this represents an enormous amount of work. Mr. Cady has been one of the men who have done the lion's share of it. I might also say that at the last meeting of the Council we voted to revise the whole book completely only every other year. However, the first part, the organization, will have to be completely rewritten, and the membership also, and the reports of committees, to a considerable extent. We felt that a complete revision would only be necessary every other year, and that might somewhat reduce the work of the committee, and also get the book into your hands a little earlier.

Secretary Chapin: I think it might be of interest to the meeting, in connection with the Year Book and the Treasurer's report, that of the income last year, upwards of $500 came from Year Books.

Dr. Olney: Mr. President, in regard to this surplus which Mr. Thompson has mentioned, I might make one statement: We induced the Textile Foundation to carry our year from the 1st of April up to the 1st of July. I think you will find that some of the apparent excess is

PRICE, WATERHOUSE & CO.
75 FEDERAL STREET, BOSTON

November 24, 1937.

To the Members of the American Association of Textile Chemists and Colorists:

We have made an examination of the accompanying statement summarizing the receipts and disbursements of the treasurer and secretary of the American Association of Textile Chemists and Colorists for the year ending October 31, 1937. In connection therewith, we examined or tested the cashbooks and other supporting records of receipts and disbursements of the treasurer and secretary and obtained information and explanations from the officials.

In our opinion, based upon such examination, the accompanying statement, together with the supporting schedule, fairly present a summary of the recorded receipts and disbursements of the association for the year ending October 31, 1937, and the balances of cash in banks as of the close of the period under review.

PRICE, WATERHOUSE & Co.

STATEMENT SUMMARIZING RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDING OCTOBER 31, 1937

Treasurer's Account	*Total*	*Allocation of Funds*			
		Research	*Merchandise*	*General*	*Annual Meeting*
Receipts:					
Secretary's receipts remitted to treasurer—					
Membership dues for the year ending October 31, 1937	$12,210.28	$2,373.00	...	$9,837.28	...
Miscellaneous income (per schedule attached)	2,019.64	197.00	$843.88	...	$978.76
Together (see below)	$14,229.92	$2,570.00	$843.88	$9,837.28	$978.76
Research donations—					
Textile Foundation	16,375.00	16,375.00	...	...	...
Chemical Foundation	2,000.00	2,000.00	...	...	...
Eavenson & Levering Co.	1,600.00	1,600.00	...	...	...
Interest on time deposit	81.30	...	...	81.30	...
Total receipts	$34,286.22	$22,545.00	$843.88	$9,918.58	$978.76
Disbursements:					
Research salaries, fees and expenses	$20,744.92	$20,744.92	...	...	...
Howes Publishing Co.—Subscriptions to American Dyestuff Reporter	4,747.29	...	...	$4,747.29	...
Secretary's expenses, postage, etc.	1,481.96	...	$36.36	1,398.85	$46.75
Printing, etc.	252.26	...	...	167.92	84.34
Merchandise purchases	121.13	...	121.13	...	...
Section membership allowances	501.00	...	...	501.00	...
Trade association dues	50.00	...	...	50.00	...
Total disbursements	$27,898.56	$20,744.92	$157.49	$6,865.06	$131.09
Excess of receipts over disbursements	$6,387.66	$1,800.08	$686.39	$3,053.52	$847.67
Cash in bank at October 31, 1936	19,821.26	5,701.12	376.82	13,552.98	190.34
Cash in bank at October 31, 1937	$26,208.92	$7,501.20	$1,063.21	$16,606.50	$1,038.01
First National Bank of Boston—Time deposit	$5,000.00				
First National Bank of Boston—Checking account	21,208.92				
	$26,208.92				
Secretary's Account					
Receipts:					
Miscellaneous income and membership dues for the year ending October 31, 1937	$14,224.62				
Membership dues for the year ending October 31, 1938	930.00				
	$15,154.62				
Disbursements:					
Remitted to treasurer (see above)	$14,229.92				
Bank charges	4.70				
	$14,234.62				
Excess of receipts over disbursements	$920.00				
Cash in bank at October 31, 1936	10.00				
Cash in Appleton National Bank, Lowell, at October 31, 1937	$930.00				

Respectfully submitted,
W. R. MOORHOUSE, *Treasurer.*

SCHEDULE OF MISCELLANEOUS INCOME FOR THE YEAR ENDING OCTOBER 31, 1937

Miscellaneous income:			
Research—			
Launder-Ometer royalties	$176.00		
Vat printing research reprints	18.00		
Carbonizing reports	1.00		
Printing paste reports	2.00		
			$197.00
Merchandise—			
Year Books		$554.15	
Dye fastness reports		1.50	

Dyed standards	43.00	
Knitted tubing	23.56	
Dyestuff Reporters	62.90	
Crock-meter cloth	22.70	
Crock meters	79.31	
Analytical methods	56.76	
		$843.88
Annual meeting—		
Registrations	$614.00	
Rhode Island Section	364.76	
		$978.76
Total miscellaneous income		$2,019.64

due to that additional payment which they have given us, so that we can change our fiscal year for research work from April 1 to July 1. In other words, the treasurer's accounts are on a cash rather than an accrual basis. That accounts for most of what would appear to be a balance above expenses.

Treasurer Moorhouse: That is true. We can go along a little farther this year with the balance left over than we have been able to before.

Dr. Olney: I don't want the impression created that the Research Committee has a lot of money it does not know what to do with. (Laughter.)

Mr. Howes: Mr. President, I think it might be well to note on the expense of the Year Book, that although I haven't the figures for this year, I am sure the advertising in it will cover the expense; but it would not have been so by quite a margin had the Association not decided to raise the advertising rates for the current year. They were raised about twenty-five per cent.

Last year, as I recall, there was only a matter of one or two hundred dollars profit on it. Of course, the expense of production will be a good many hundred dollars more this year than it was last year, so that without the increase in advertising rates, we would have been well in the red. We are somewhere on the right side this year. I don't remember the exact figure.

President Cady: I will next ask Professor Olney to report for the Research Committee.

REPORT OF RESEARCH COMMITTEE

Dr. Olney: The report of the Research Committee appears in the Year Book. That has been brought well up to date. It gives a complete list of all of the recent publications of the Research Committee, so I don't think that anything would be gained by taking the time now to go into that any further. You will find that it is in the very first section of Part 2, headed, "Report of the Research Committee."

President Cady: I will ask Mr. Moorhouse if he has any report to make for the Committee on Constitutional Changes.

REPORT ON CONSTITUTION

Treasurer Moorhouse: I don't think they are crystallized enough to make any report at the present time.

President Cady: Perhaps I should explain that at a meeting of the Council last year a committee was authorized to go over the entire constitution and see what changes it might be desirable to make. The feeling has been expressed frequently that our constitution, which was written back in 1921, has been somewhat outgrown, and in order to adapt it to the growth of the new Sections, and that sort of thing, it might be desirable to make some radical changes.

The committee has gone still further and has completely rewritten it, with the idea of dividing the entire document into two parts, a constitution and a set of By-Laws, the constitution to be more or less permanent and the By-Laws to be changeable at the will of the Council. This matter was not carried far enough this fall to present at this annual meeting, but it is intended, I think, to bring it before the membership next year early enough in the year so that it may receive adequate discussion, and be put up to the annual meeting for action next December.

There are one or two radical changes which have been proposed and which you will hear about somewhat later. One proposal is to abolish the Councilors-at-Large and have all councilors elected by the Sections. Another proposal is to abolish the Committee on Nominations and have the councilors who are elected by Sections act as the Nominating Committee.

You may find it a little bit difficult to digest those two proposals right now, but think them over, and you will hear more about them later.

Is there any other business to come up at this time?

Mr. Killheffer: Mr. President, I seem to be unacquainted with the new procedure. When do the new officers take office?

President Cady: Under the constitution, the polls do not close until December 15, and the new officers will take office January 1.

Mr. Killheffer: When was that change made?

President Cady: Last year. If you will read the new Year Book, you will see the new wording.

Mr. Killheffer: May I inquire as to the purpose of that change?

President Cady: The purpose of that change was to make it possible to hold an annual meeting at a time other than the first week in December, and not conflict with the annual election. The election, according to the constitution, had to be announced at the annual meeting. We have had one occasion before when we wanted to have the annual meeting at another time than December. That was at the time when we went to Chicago. That year we had to have a second meeting in December in order to meet the constitutional requirements. Under the new system the election is entirely divorced from the annual meeting.

Mr. Killheffer: While you may have gained something, I think you have also introduced a rather unfortunate consequence by the change. There is no need to discuss it here, but I think I can see several unfortunate consequences.

President Cady: The matter was discussed at some length last year. I didn't hear any objection at that time. Perhaps when the new constitution is under discussion next summer something may be said on that subject.

Is there any further discussion, gentlemen? We will not be in session again until next December.

I declare the meeting adjourned.

. . . Whereupon the meeting adjourned at twelve-forty-five o'clock . . .

The Quantitative Measurement of

Stiffness and Resiliency*

DR. ERWIN J. SAXL†

IF any sheet-like material like cloth is subjected to bending, the forces necessary for this deflection will be high when dealing with a stiff material.

On the other hand, with a soft material, hardly any force will be necessary in order to deflect it. As a matter of fact, a very soft material will deflect under its own weight, thus producing draping effects. It is here where difficulties arise when trying to differentiate between the absolute stiffness as such and, on the other hand, the relative stiffness that is influenced by such factors as specific gravity of the material, cloth construction, and the like.

STIFFNESS MEASUREMENTS

Stiffness measurements are not new. For centuries man has attempted to evaluate stiffness empirically. Quantitative work was started as early as 1878 by Koch[1]. Another early construction of a device for testing rigidity is described by Tutton[2].

A number of machines were developed subsequently for the purpose of evaluating stiffness. Some of them are based upon the fact that the test piece is subjected to the force of a pendulum that strikes against it, and, according to its resiliency, swings farther or less far. There are three constructions of that nature on the market.

Two other machines are based upon the reaction that cloth has against deflection if such deflection is applied by the aid of calibrated springs. In connection with this, particular reference shall be made to the excellent research work of Dr. Schiefer.

The original Stiffness Tester designed by the writer[3], was constructed primarily for the determination of stiffness in individual yarns. In subsequent practice it was found, however, that an instrument of larger range and accommodating heavier cloth as well, would have an extended range of usefulness for the industry as well as for pure research.

In bringing out a new Stiffness Tester, some reasons may be mentioned why this new construction was designed and the method developed.

First of all, it was founded on the age-old principle that in measuring textiles—or any other material at that—only the object to be measured should be moved and nothing else.

Another principle that must be employed in the design of fundamentally correct testing machinery is, that methods of measurement, if at all possible, should be reduced to the measurement of length and weight. That is to say, it is desired to measure precisely the variation in the shape of the test piece as produced by such deflecting forces.

In order to maintain the standards of precision, now and fifteen years from now, the simplest and most reliable way is the gravimetric measurement. Accordingly, a machine was designed that is free from any objects that could possibly produce variations over a period of time. No springs are employed because they have the following disadvantages:

1. They oxidize.
2. Their modulus of elasticity changes over a period of time.
3. They require repeated calibration.

*Paper delivered before the annual meeting, Philadelphia, Pa., December 4, 1937.

†Consulting Physicist and Chemist of Providence, R. I.

[1]Koch. Wiedemann's Annalen 5, 253, 1878.

[2]Tutton, Philosophical Transactions A, 202, 143, 1903.

[3]Irving J. Saxl, "The Quantitative Determination of Stiffness in Individual Yarns." Textile Research, Vol. VI, No. 3, pp. 152-6 (1936).

4. If a spring is not to be over-stretched beyond its modulus of elasticity and yet be sensitive enough, the range of the spring-operated instrument is limited, and quite a number of separate apparatus are required to cover, say, the range between soft muslin and heavy overcoating.
5. The resistance of a spring and thus the force exerted, changes with the temperature.

Equally, all methods were discarded in which the cloth deflects at its own weight. Obviously, all measurements that should bring about an objective evaluation of stiffness as such, must be independent from the specific gravity of cloth. If no compensation is made, for the influence of the specific gravity, then a heavier cloth will give different results than a light cloth without artificial loading. Yet, the stiffness as such may be the same in both instances. It is for this reason that all methods by which cloth is deflected under the influence of its own weight have been discarded as fundamentally incorrect in their basic principles.

In stiffness measurements, it should be possible to measure anything from silk and very soft yarns to as stiff materials as carpets, with one single instrument, if possible. The wide range of such an apparatus combined with the necessary sensitivity makes the application of a gravimetric system based upon a balance as used in the new construction, a necessity. Equally, means must be provided to compensate for the influence of the weight of the cloth.

THE APPARATUS

Fig. 1 shows a close-up picture of the Stiffness Tester. A test specimen is inserted in the left clamp where it can be deflected. The rotation of the test specimen out from the horizontal can be read quantitatively on the protractor which is divided in ½ degrees from 0 to 90 degrees.

On the right side is a balance with a sensitivity of 0.02 gram. It is self-contained with sliding weights. If a test specimen is pressed down upon the left side of the balance arm, the left side of the balance arm will tend to move downward while the right side of the balance, together with the pointer, will have a tendency to move upward.

If a weight is moved outward on the balance arm, the right side of the balance has a tendency to go down. If the right side of the balance goes down, the left side goes up. If the protractor is now turned downward, then, the specimen will press upon the right side of the balance. If the pointer of the balance is back to zero, this pressure of the deflecting force must then be equal and opposite to the action of the weight at the right side of the balance.

It is obvious then, that for one and the same given weight, say, for instance, ten grams, and one and the same given test specimen, say, a strip of cloth measuring 2 x 6 inches, hardly any deflection as read on the protractor need be applied if the test specimen is stiff, because then it will hardly give. On the other hand, in dealing with objects of great softness, it will be necessary to bend

Fig. 1—The Stiffness Tester.

them through all the way, and then on the protractor we will read a larger number of degrees. In this manner the stiffness of two identical specimens can be differentiated.

By the application of a flexing member and a balance, there is nothing that can easily get out of order. The balance will be as precise today as fifteen years from now. Equally, no changes are introduced in any other part of the instrument. The only moving member is the specimen of cloth or yarn.

There are some further details in this instrument that permit the combination of extreme sensitivity, extreme range, and at the same time elimination of the influence of the specific gravity of the test specimen.

COMPENSATION FOR WEIGHT OF CLOTH

At the right side of the balance there is a moving weight, consisting of a cylinder that moves on a screw. At zero position of the protractor, the right side of the cloth rests freely upon the left side of the balance. The weight of the cloth proper then presses the balance down. This original pressure (proportionate to ½ of the weight of the specimen to be tested) can be compensated for by moving the weight upon the spiral at the right side of the scale. In this manner, absolute zero conditions are established at the very outset.

The riding weights may now be moved out; then, the protractor is turned to approximately the correct position, the balance disarrested, and the hand on the protractor

turned until the pointer of the balance is brought back to zero exactly. In this manner the testing results are free from the influence of the weight of the test specimen.

BROAD RANGE OF APPLICATION

As to the range of objects to be measured: The movable arm with the protractor is attached to a sled and on this sled it can be brought nearer to the balance or farther away. The total range is 1.5 centimeters at minimum distance, and 8 centimeters at maximum distance. By this means, it is possible, to a very large extent, to accommodate one and the same apparatus for measurement of pieces as soft as the finest muslin or silk, down to actual pieces of rug and winter coating.

It will be understood that if a long piece is used, its stiffness is distributed over a longer distance. Furthermore, if desired, it is possible to make this long piece of stiff material rather narrow, say one inch wide, while the short piece of soft cloth may be as wide as six inches. If necessary, several pieces of cloth may be used one on top of the other. Accordingly, with the total weight of 101 grams available, rather stiff objects such as overcoating and steel strips, heddles for instance, can be accommodated. On the other hand, for soft objects such as silks, the movable left clamp is brought near to the balance arm and the fine division of 0 to 1 gram in steps of 0.02 gram is used.

In the following graphs some of the results obtained on actual samples are discussed. In Fig. 2, the measurements of a piece of fabric that was subjected to deflection have been plotted. A great number of points were measured on the upgoing part of the characteristic. Instead of plotting the angle as such (which is read on the protractor), the tangent of the angle has been plotted (for theoretical reasons discussed elsewhere). The more grams needed for the same deflection, the stiffer the fabric and the greater is the angle. On the other hand, the softer the fabric, the lower the angle on the graph. (But, the greater the angle on the actual measurement.)

Thus far, the ascending part of the total diagram has been discussed exclusively. In actual practice it is not always necessary or desirable to take a complete line. All that is required is saying to the finisher-foreman: "I want you to keep track so that your fabrics at ten grams load will have a deflection of, say, from 20 to 30 degrees."

In other words, that would keep him within a reasonably narrow spread of the curve which is proportionate to the actual stiffness of the fabric.

PERCENTAGE OF RESILIENCY

So much for the stiffness determination as such. However, there is more which can be derived by the systematic use of the Stiffness Tester. If, after application of the load, the testing procedure is continued by reducing this load again, the results obtained therefrom will not return within the same linear function. Instead of this, a curve

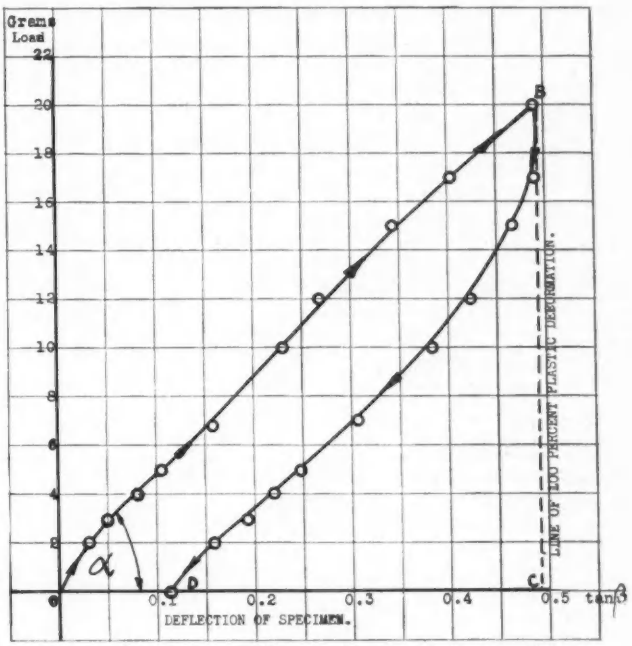


Fig. 2—Load-versus-Deflection Characteristic of a Fabric.

B-D is produced which is apart from the virgin curve O-B. If the material would have remained 100 per cent plastically deformed, the original material would have retained its original deflection, regardless of how far it is returned. In other words, the descent would have been parallel to the ordinate, according to the theoretical line B-C.

On the other hand, had the test specimen had 100 per cent elastic recovery, such as a razor blade or a fine-tempered steel, then it would have returned 100 per cent within the original curve of ascent or B-O. That is to say, from 100 per cent plastic deformation, included in the triangle O-B-C, to zero plastic deformation, which is included in the line of ascent O-B, the relative recovery can be calculated quantitatively.

The area of the hysteresis loop may be determined, for instance, by counting the squares on the graph, by cutting the hysteresis loop out of the graph paper and weighing it, or by circumscribing the area with a planimeter similar to that used for power diagrams. The ratio of the weight of this area, O-B-D, to the total triangle O-B-C is then the ratio of elastic recovery, the percentage of resiliency, or the inverse of it, the percentage of plastic deformation.

This, it is believed, is the first approach to quantitatively evaluating per cent of elastic recovery of textile materials in an absolute system, as we are dealing with actual work done and also quantitatively with the work recovered.

We can state that

$$W = L\theta$$

Hereby is

W . . . . . the work done in ergs.
L . . . . . the torque in dyne-cm.
θ . . . . . the angle of deflection in radians.

CRUSH PROOFING TESTS

Finishes of fabrics can now be designed in accordance with trade requirements in coordination with the scientifically correct findings of the stiffness and recovery curve. For instance, in the case of a crush-proof fabric, a cloth containing urea formaldehyde or other resins that will permit an easy recovery the question may be asked: What will be the requirements for such a fabric? The requirements will be that the plastic deformation or the permanent deformation, shall approximate a minimum. In other words, for a given deformation, the percentage area of the hysteresis loop O-B-D, against the total area O-B-C, should be a minimum.

It is now the interesting problem of the dyer and finisher to achieve such a permanent recovery without unnecessarily increasing the stiffness of the fabric. If a fabric is made—to go to an extreme—of something resembling a steel blade, like a razor blade, then there is no crushing. But, how stiff is it? In other words, in a crush-proof cloth of good recovery, yet soft, *it is desirable to achieve a small area of the hysteresis loop without lifting the ascending branch of the characteristic.* With a minimum of stiffness, a maximum of elastic recovery, or the minimum area of the hysteresis loop should be combined. This is the ideal requirement of a fabric that is soft to the touch, yet has good recovery characteristics.

EVALUATION OF SIZES AND SOFTENERS

While fabrics have been exclusively discussed in this paper, it can be seen in the next diagram (Fig. 3) that the same way of reasoning applies also to other materials such as sizes (or the inverse of them, softeners). The very soft unsized yarn with hardly any angle in the load-deflection characteristic—and the very same yarn, from the same bobbin but sized—is ever so much stiffer. By this means, the stiffening action of sizes and vice versa can be evaluated and it can be determined which softening agent is better. For the same amount of sulfonated castor oil, added to the water, the deflection of the angle α (of figure 2) on the graph will be lower, the higher the effectiveness of the softener. Quantitative evaluation of stiffness and softness, of stiffening agents and softening agents, or in other words, the exact dollar and cents' value of textile auxiliaries can be determined in this manner.

INFLUENCE OF THE YARN AND CLOTH CONSTRUCTION

Another item worthy of mention is the difference between the ascending branches of various characteristics as per different yarn and/or cloth constructions. To be sure, the steeper the ascending branch is, the stiffer the fabric or the stiffer the yarn. But, to get to almost the identical point of stiffness at one given point, it is possible to go there through different ascending branches.

At a total deflection of 90 degrees, two materials, A and B, are identically stiff. Yet, at lower deflection, 40 and 50

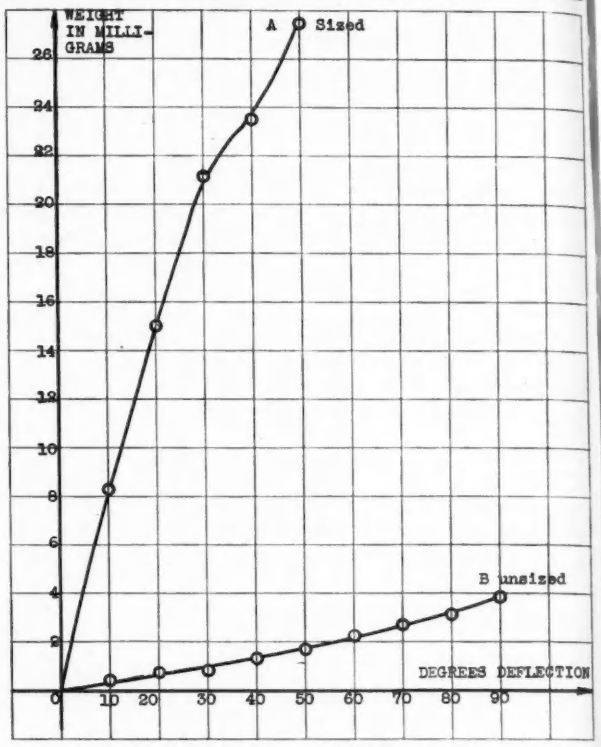


Fig. 3—Load-versus-Deflection (Stiffness) Characteristic of Sized and Unsized Acetate Rayon Type Yarn.

degrees, the fabric, represented by the curve B, is softer. It is interesting to note in this connection that the lower branch of the characteristic was circumscribed by a yarn that was constructed by only 2.65 deniers per filament, while the same type of viscose yarn of the same manufacturer that showed greater stiffness at lower angles of deflection, had 3.75 deniers per filament.

CONCLUSION

Concluding, then, it may be stated that, by the application of sound physical principles, methods have been developed that permit the quantitative evaluation of stiffness of fabrics and yarns. They may be used to determine objectively the handle and feel of fabrics and the effectiveness of softening and stiffening agents.

The apparatus consists essentially in a deflecting member in which one side of the test specimen is clamped. The other side of the specimen rests freely upon a balance of sufficient sensitivity. By turning the test specimen in the protractor and measuring the force necessary to compensate for this deflection on the balance, a load-versus-deflection characteristic may be determined quantitatively. The balance also possesses means for compensating for the specific gravity of the test piece.

The steepness of the ascent of the load-versus-deflection characteristic and the mechanical hysteresis, and elastic recovery, can be measured just as can be determined the stiff-

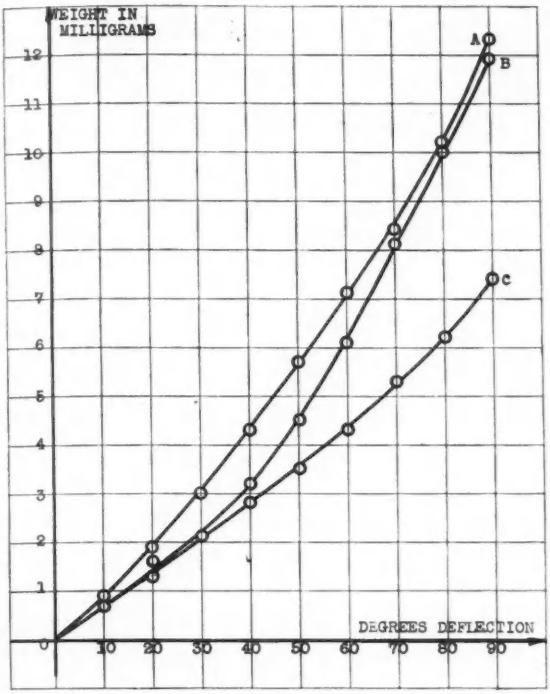


Fig. 4—The Influence of the Number of Filaments, their Diameter and Chemical Constitution upon their Load-versus-Deflection Characteristic.

A—150 Denier, Viscose Rayon Type Yarn. 3.75 Denier per Filament.
B—200 Denier, Viscose Rayon Type Yarn. 2.65 Denier per Filament.
C—150 Denier, Acetate Rayon Type Yarn. 3.00 Denier per Filament.

ness changes at various degrees of deflection of the test specimen.

Accordingly, it may be measured how the drapiness, handle and feel will be dependent upon various conditions of yarns, cloth constructions, textile auxiliaries and finishing processes. All these tests can be made in a quantitative manner and not dependent upon the subjective impressions of different observers.

1. Adams, F. W., and J. Bellows. The Value of a Paper Stiffness Test. Tech. Assoc. Papers (1933). (G. S. Witham, Jr., U. S. Patent 1,385,164—November, 1921.)
2. (Anon.) Paper Trade J., 97, No. 22:28 (Nov. 30, 1933).
3. (Anon.) Gurley, R. D. Stiffness Tester. Paper Trade J., 99, Nos. 25:43, Dec. 20, 1934.
4. Bragg, A. C., Stiffness Tester for Boards, Paper (Nov. 20, 1924).
5. Clark, James d'a., Determining the Rigidity, Stiffness, and Softness of Paper. Paper Trade Journal, March 28 (1935), pp. 41-44.
6. Ewald, W., New Stiffness Tester for Paper. Paperfabr. (May 15, 1927).
   E. C. Carter. The Carter Paper Stiffness Tester. Paper Trade J., 93, Nos. 15:54 (Oct. 9, 1931).
7. Heritage, C. C., E. R. Schafer and L. A. Carpenter. The Measurement of the Strength and Stiffness of Fiber Boards. Can. Pulp, Paper (Oct. 31, 1929).
8. Jordan, Verhandlinger, d. Phys. Ges. 1915, 423.
9. Kohlrausch, F., Praktische Physik, pp. 233.
10. Martin, R. I., and G. R. R. Bray. Flexibility or Stiffness Tests Using the Flexometer. World's Paper Trade Rev. (Dec. 29, 1933).
11. Micoud, H. Le Papier, pp. 251-258 (1931).
12. Pierce, F. T., Influence of Humidity on Elastic Prop. of Starch Film. Journal Text. Inst., 19, T237 (1928).
13. Riesenfelt, E. H., and T. Hamberger. Testing for Stiffness of Paper. Papierfabr. (Nov. 17, 1930).
14. Saxl, Irving J., The Quantitative Determination of Stiffness in Individual Yarns. Textile Research, Vol. VI, No. 3, pp. 152-6 (1936).
15. Saxl, Irving J., Determination of Stiffness, Rayon and Synthetic Yarn Handbook, pp. 372-376.
16. Schiefer, Herbert F., Evaluation of Crush Resistant Finishing Treatments for Fabrics. AMERICAN DYESTUFF REPORTER, Nov. 1, 1937, pp. 667-668.
17. Schiefer, H. F., The Compressometer, an Instrument for Evaluation of Thickness, Compressibility, and Compressional Resiliency of Textiles and Similar Materials. BS. J. Research, 10, 705 (1933), RP. 561.
18. Schiefer, H. F., Bureau Std. Journal Research (May, 1933).
19. Schiefer, H. F., Flexometer. Textile Res., Vol. III, No. 8, pp. 388 (1933).
20. Schultz, H., and W. Ewald. The Stiffness of Paper and Its Measurement. Papierfabr., Nov. 28, 1925.
21. Smith, S. F., The Rigidity of Box Board. World Paper Trade Rev. (Feb. 1, 1933).
22. Stuart, W. H., Paper Stiffness Tester. Paper Trade J., 93, Nos. 21:39 (Nov. 19, 1931).
23. Warburg, U., Heuse, Verh. D. Phys. Ges., 1915, 206.

The next

Quarterly Research Number

will appear

April 4, 1938

Suggestive Observations on the Wetting, Mercerization and Dyeing of Celllose*

PART I

CHARLES F. GOLDTHWAIT†

THIS paper as a whole presents incidental observations made during extensive studies on processing cotton. These observations are believed to be of some general interest, and may in some instances be suggestive for mill processing. However, they are offered mainly because they seem to represent clues which suggest additional research which may, in turn, help explain important cellulose phenomena.

1. DIFFERENTIAL WETTING OF CELLULOSE

This title covers experiments wherein one seems, paradoxically, to be able to make cellulose *resist wetting* (to a certain extent) by means of *water*. Cellulose which has already been wet in a limited manner appears to remain less wet upon subsequent dipping in water than the original air dry cellulose when it is similarly dipped. It also resists dyeing to a certain extent, although this may be but an extension of the resistance to wetting.

This no doubt sounds somewhat improbable, if not revolutionary, so a few typical experiments and results will be described.

The experiments are extremely simple but the author has not found any mention of precisely this phenomenon in the course of a wide reading on the relationships between water and cellulose. The results readily suggest much additional research of a rather general nature and may prove to be very significant for various processes involving cellulose, and possibly other materials.

The first observation was made by accident on a piece of heavy, bleached, woven, mercerized cotton fabric containing a finish, probably partly neutralized stearic acid. One end of a strip was dipped into soda for a test for another purpose and the fabric then held under the tap to rinse out the alkali. There immediately appeared under the running water a "dry" zone across the strip. This zone was the area into which the solution had crept by capillarity while the cloth was partly immersed in the soda. In repetitions of the test the area of capillary rise appeared to be wet but under the running water during rinsing it looked dry.

In other words, this wet or partly wetted area resisted further wetting by the running water although the area above it, not previously wet, was wetted very readily.

As a further test and in order to preserve a visible record of the experiment the fabric after dipping, capillary rise and complete flooding with water was stained by immersion in a cold strong solution of a direct black dye and rinsed. The theory was that if the partially wetted area resisted further wetting by water it should resist wetting by a dye solution and become less stained. Fig. 1 shows the result. The areas which were really wet have become dyed while the area with limited wetting has remained relatively undyed.

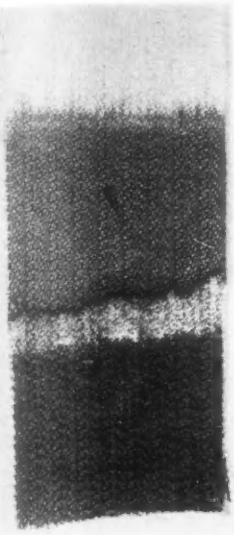
Considering merely wet and dry fabric this is just contrary to what would be expected. Under the conditions of these experiments a dry area in this sort of a fabric should dye more quickly than a wet area and look darker. As a matter of confirmation this was tried and found to be true, but for convenience it will be shown here on filter paper, rather than on fabric. The principle is the same.

Fig. 2 shows the result of dipping the two ends of a strip of filter paper into water and then transferring to a dye solution while there is a small dry area (B) in the middle. The effects of capillary creep from the wetted ends also show at the two long boundaries of the dark area, as lighter lines. This strip of paper would tend to dye to a uniform shade if dyed for a longer time. The light area on the fabric, as in Fig. 1, has not done so within the limits of the experiments. Obviously then the partly dry (or partly wet) area shown at B in Fig. 1 was not merely partly dry but was conditioned in some particular manner to resist further wetting with both water and dye solution.

Figs. 3 and 4 show the result of another test made in a different manner with the same materials. A large drop of 10 per cent sodium carbonate was allowed to stand on a piece of the fabric for 10 minutes. There was penetration in the center area and capillary creep into the lighter colored zone. Upon rinsing, the fabric as a whole was wetted very quickly, but the capillary zone and the spot on the back (Fig. 4) looked dry while the central spot was wet.

*Presented at Annual Meeting, December 4, 1937, Philadelphia, Pa.

†Industrial Fellow Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania.

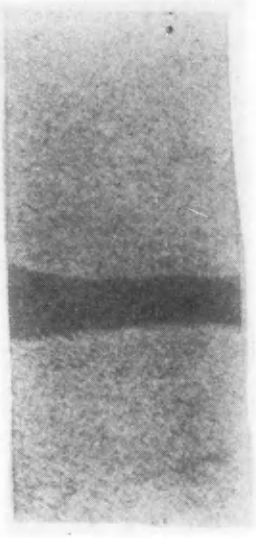


C.—Wet later

B.—Capillary rise

A.—Dipped

Fig. 1



A.—Wet

B.—Dry

A.—Wet

Fig. 2

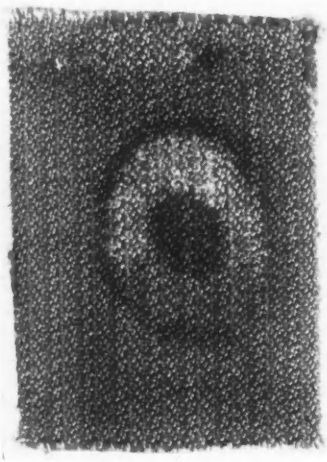


Fig. 3
Capillary creep from a drop.

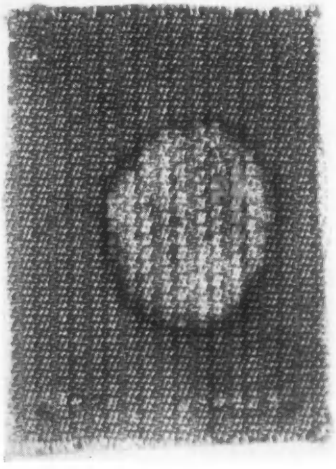


Fig. 4
Back of spot—wet by capillarity.

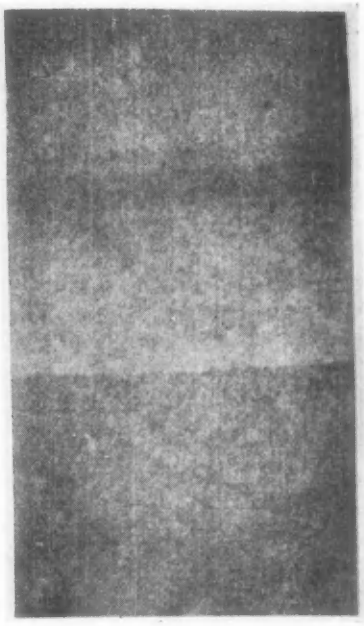


Fig. 5
Wet filter paper showing effect of capillary rise on wetting and on dye absorption.

Upon dyeing in a cold dye solution the fabric came out as shown.

A darker dyed line above or outside of the capillary zone has been noted and shows in the illustrations, but any attempt at explaining it will be omitted for now.

The experiments as described are not very scientific and are complicated by too many materials. They represent a special case noted by accident and have been given laregly because the fabrics could be photographed fairly well and it was not possible to contrive any other so satisfactory form of illustration.

The rather particular conditions of these experiments are not necessary for the fundamental action which is involved here.

It was found that all of the essential features could be reproduced with distilled water and pure filter paper; also with suitable unsized and blotting papers, and with ordinary bleached cloth. All materials do not react equally well. The presence of foreign matter such as finishes or wetting agents may have some effect, but apparently one of the most important factors is a slow capillary creep. Too rapid a creep or rise is apparently about the same as rapid wetting with an excess of water. Hence there is no differential wetting effect.

As a specific example a strip of Whatman No. 42 acid washed analytical filter paper (pure cellulose, for the present purpose) was dipped quickly for an inch into distilled water and allowed to remain with the end in water for

about five minutes, until there was a capillary rise of about one inch. The filter strip, partly wet and partly dry, was then totally immersed in the water, quickly withdrawn, immersed for a short time in a solution of black direct dye, such as Erie Black NR Extra at two grams per liter, until it was dyed lightly, and rinsed cold. Fig. 5 represents a photograph of a strip treated in this way, taken while still wet.

In general, after complete immersion in water, before coloring, the capillary area gives the appearance of being less wet than the rest, and looks less transparent when viewed toward the light.

To make the points as plain as possible, after dyeing there is a lighter colored zone which was originally wet by capillary rise, and darker areas above and below which were wet by quick dipping. The capillary zone was also dipped quickly for the same length of time as the upper part of the paper so it was really wetted twice. However, it has failed to dye as dark a shade and the only thing that could have interfered is some effect from the absorption of water by capillarity. In other words, differential wetting has caused a dye to be partly resisted under these particular conditions, although as already mentioned it is probably a partial resist to wetting rather than to dyeing.

In many instances the differences in shade in test papers are less pronounced after drying but show well again upon rewetting.

There is direct evidence that the area of capillary rise is less wet than the area of the paper which was dipped rapidly. Experiments were started like that just described. After the capillary rise had taken place to a sufficient extent, the paper was withdrawn from the water, excess water removed by blotting, the paper cut into pieces, and samples representing the different areas weighed, dried and weighed again to determine the amount of water retained:

TABLE I

	Percentages of Water Retained in Blotted Paper — Dry Basis		
	Area Dipped First	*Area of Cap. Rise*	*Area Wet Only by Final Immersion*
1. Filter paper — one end dipped and capillary rise allowed	128	95	...
2. Filter paper treated in the same way then completely immersed	125	100	111
3. Blotter-treated like 1....	190	150	...
4. Blotter-treated like 2....	198	166	183

These were only rough experiments but they show the area of capillary rise to contain less water than the area which was dipped quickly and held immersed while capillary rise was taking place. This dipped area did not gain while the whole piece was being immersed. The capillary area gained a little but did not become thoroughly wet, although twice subjected to wetting. Finally, the top of the paper which was immersed once and quickly withdrawn was wetted to an intermediate degree as might be expected.

Again, it may be pointed out that the area which is least wet will dye lightest instead of darker as would be expected. (Note Fig. 2.)

As in the case of the fabric, the same type of spot experiment can be made with a drop of water and piece of filter paper. The drop is allowed to spread by capillarity, then the whole piece immersed in water, dyed and rinsed as in the other experiments. The spot first wetted by the drop dyes dark; the zone wet by capillarity looks less wet when immersed in water, and colors to a lighter shade; the outside area dyes darker, about like the drop at the center.

These effects are general enough so that they may possibly occur in different kinds of goods undergoing different kinds of processing, and can conceivably help explain irregularities in dyeing and perhaps spots. There has not been an opportunity to go into this branch of the subject, but these observations did give a clue to the solving of a difficult problem in dyeing. It has been clearly seen, for example, with the particular fabric under discussion that the dipping, capillary rise, redipping and dyeing will give the same result, although to a less pronounced degree, if carried out at temperatures up to 175° F. The light area is covered if the treated fabric is dyed at the boil.

A possible general explanation is that the effect is due merely to entrapped air which is not displaced from the capillary area when it is subsequently immersed in water, but this alone does not seem adequate. The air is apparently displaced readily from the other parts of the paper by simple quick dipping into water. Why should it be retained in an area which is not fully wetted the first time, by capillarity, but which is afterward dipped like the rest? It would seem that there must be a difference in the initial wetting, between that by quick dipping and wetting by capillary rise.

The idea that it is trapped air alone will hardly account for a similar result in another type of experiment. If a strip of the filter paper has a part kept dry and a part exposed to an atmosphere approximately saturated with water vapor, and is then dyed in a cold solution (as before) the humidified section will dye lighter although neither part was wet in the ordinary sense. Or, if the partly humidified paper is totally immersed in water it will probably appear a little less wet in the humidified area and this part will dye a distinctly lighter shade.

Here again water applied to cellulose in a limited way has given a different effect from water applied quickly "in bulk." The first seems, in some way, to promote the retention of air and to interfere with subsequent absorption of water from the liquid form.

While one hesitates to get into such involved explanations, it seems quite possible that impurities, such as stearic acid or adsorbed gases from the atmosphere may play some part in influencing or controlling the sorption of

water from a limited supply such as a humid atmosphere or the advancing edge of water moving by capillarity. Whether such impurities come into the action or not, there are evidently very different results from these special kinds of wetting, as compared with sudden wetting by an excess of water.

When we postulate some special kind of wetting we automatically think of orientation. It would be rather peculiar to find water orienting itself so as to resist wetting by more water, although perhaps not totally impossible. In the present case it would seem that the water of limited wetting must act in some way with impurities or air to cause the resistance to further wetting. Under such circumstances there might be orientation of both adsorbed water and impurities and a consequent tendency to protect the cellulose from further wetting by liquid water.

The author does not have opportunity to continue this study to any extent although a more scientific investigation might be of some value. This work has mostly been done "on the side" as a hobby. Many additional simple experiments have been made and others will readily suggest themselves, possibly enough so that one more paper can be prepared. It is hoped that the material is of sufficient interest for someone to follow it through to a complete explanation.

2. WETTING OF COTTON GOODS

It is well known that cotton goods may seem to be wet when they may not be fully wetted. Goods in the grey or natural state show this very well and attention will be called to some simple experiments which may emphasize possible defects in wetting and perhaps present the subject in a somewhat new light.

If grey cotton strips, preferably not complicated by size or a too porous structure, are dipped into water at various temperatures up to the boil, the cloth is obviously not wetted up to a fairly high temperature, perhaps 200° F., then at higher temperatures it may appear to be pretty well wet but at some point there is likely to be a sudden rush of bubbles from the goods and the cloth is undoubtedly thoroughly wetted.

The air which (sometimes) bubbles out so suddenly is that which is enclosed in the mesh of the fabric and it may include gas which has been adsorbed from the atmosphere. The complete release seems only to follow true complete wetting of the goods.

There appears, therefore, to be a sort of critical temperature for the complete wetting of grey and natural cotton goods, depending somewhat on any previous treatment. The point is likely to be between 200° F. and boiling. For example, a grey cotton and a similar processed cotton fell within this range and about 5° apart.

This point is hardly of the nature of a physical constant although it might approach it for native raw cotton in some standard form.

Here again, not much is known about the observation which is being discussed, for example, to what extent it is influenced by mechanical pressure or circulation. It should apparently be given attention in cases where it is difficult to reach the boiling point of water and where there may be a doubt as to the completeness of wetting.

To illustrate, unbleached materials have been wet-out at temperatures just below that of complete wetting, 190° to 195° F., and they looked well wet. Duplicate samples were wet-out for the same length of time at 208° to 210° F. All were cooled in water and then dyed together at some temperature not above the lower wetting range, such as 170° to 190° F., in the ordinary manner with salt, but no wetting agent.

As a rule the goods which were wet-out at the lower temperature, but appear to be as wet as the others, will dye appreciably lighter. Much will depend upon the goods, the temperatures selected and the dye used. Compound formulas are likely to show greater differences. Too high a dyeing temperature tends to cover the difference.

It is not possible to demonstrate these points very well except in the laboratory or mill, but enough has been done to show that one can easily overestimate the effectiveness of wetting, and that incomplete wetting may lead to unexpected faults.

While watching numerous experiments of this general nature it has appeared that exposure to steam may be a factor in the slow wetting of goods in hot water before the air in the goods is driven out. If so, this would be analogous to the tendency of the humidified filter paper in the previous section to resist further wetting. Goods in process may have direct exposure to steam or vapor from a hot bath, or if they are immersed and contain enclosed air, that air is no doubt saturated with water vapor and may produce something of the same effect as on the filter paper.

It has been proved that this is possible, at least to a certain extent. Strips of Whatman No. 42 filter and of bleached mercerized cotton fabric were partly steamed in warm steam over an open jet for lengths of time up to five minutes, then each strip, partly steamed and part not steamed, dipped momentarily into distilled water and then into a dye solution such as already described, at room temperature. Too much cannot be expected from such an experiment but it was found that the steamed areas dyed definitely lighter than those not steamed, in a majority of the trials. Again, as in Section 1, a particular limited wetting has led to a tendency to resist further wetting and dyeing. It seems reasonable to assume that steam at higher temperatures would have similar effects.

The results obtained by humidification and steaming suggest that we have here about the same thing as the von Schroeder paradox, according to which an elastic gel-like cellulose shows a greater sorption of water from the liquid than from vapor of 100 per cent saturation, although this should not, theoretically, be the case.

From the practical point of view this may seem to be a little tardy because modern wetting agents are helping to

solve many problems. However, the fundamental things are still water and cellulose and it might be worth while if such studies as there could be extended, with the possibility of bringing out some of the properties of natural or refined cellulose more clearly.

3. SWELLING OF COTTON BY CAUSTIC SODA

This section, while it concerns mercerization, is really on the swelling of cotton in caustic solutions. In reworking the data and studying the results of many researches on mercerization and swelling of cellulose by caustic alkalies various cases have been found which follow the compound interest law. That is, the data suitable plotted fall in straight lines on semi-logarithm paper.

This law means that the increase in a sum of money at a fixed rate of compound interest takes place in proportion to the sum at any given time. In terms of experimental work, whatever is happening is taking place at a given rate, to an extent which depends upon the sum of what has already happened plus what one started with.

The fact that so many of the data fall completely or partly on straight lines with good evidence of definite changes of rate at particular caustic concentrations, and with nearly the whole system falling into a fairly consistent pattern, suggests very strongly that some important underlying effect in the action of caustic on cotton follows some such law. Also, it seems perfectly reasonable that it should.

The first illustration, in Fig. 6, is taken from recent data from Prof. Bancroft. He obtained a pronounced "S" type of curve for the amount of caustic absorbed from solutions of various concentrations. The same data, recalculated to percentages to correspond with the work of others, fall very closely on a straight line at a steep slope, and a line which is approximately horizontal.

The other curve in Fig. 6 reproduces in a similar manner a record of similar work on cotton yarn by Rassow and Wadewitz. The curve on semi-logarithm paper is very similar to the first, but indicates some continuation of the increase in absorption, at a new rate, rather than approximate constancy*.

Fig. 7 shows tracings of the originals, and replotted curves for data from Coward and Spencer. Other data of theirs give somewhat better curves on the semi-logarithm paper but these were selected as coming nearest to swelling of both fiber and fabric, and to the fundamental caustic absorption. The comparison of the two types of volume curve is perhaps not very convincing by itself. The preferential absorption for fabric follows reasonably closely to straight lines except at the lower end where there is no doubt a different sorption process and strict consistency can hardly be expected. This plotting shows a very definite change of rate much better than the original.

In all four of these replotted curves the turning point is not far from 14 per cent, which is certainly more than a coincidence. These researches were made by different people on different cottons in three different countries, but there is an underlying similarity in the results. Numerous data from other researches have been replotted and found to have this general similarity. A large part of this work was originally intended to show whether there are true alkali cellulose compounds, and their composition, rather than swelling effects.

Fig. 8 shows a quite different group of results. The first curve shows the original and a replot of the heat effect data from experiments on the swelling of cotton (Barratt and Lewis.) This is somewhat similar to the other curves but it has an extra inflection (also found in other instances). Some other effect than heat of swelling or adsorption may enter into the results, especially at either end of the curve.

The other two are for old data on dye absorbed (Knecht), as measured by analysis, and for moisture absorbed (Higgins) both being determined for cotton mercerized at various caustic strengths. The lower curves are direct plots of the observed data and are on too small a scale. They hardly work out completely to straight lines. However, if the differences between the values for untreated and for the various mercerized cottons are plotted, that is, the increases in adsorption, we get some good looking results which seem consistent with the rest but may be more difficult to interpret. There is a striking similarly between the dye and heat effects.

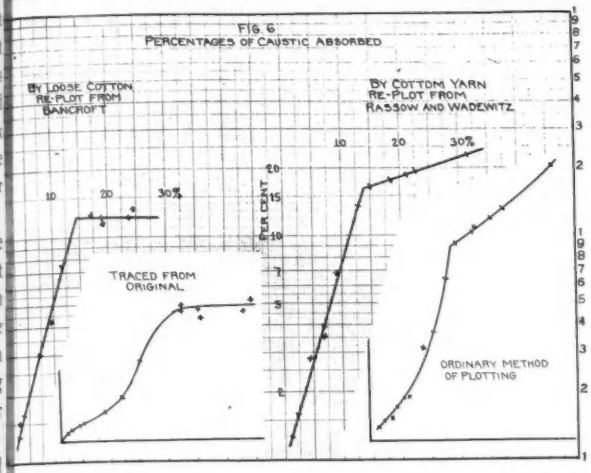
All of this work was based on the treatment of cotton fiber, yarn or fabric without tension.

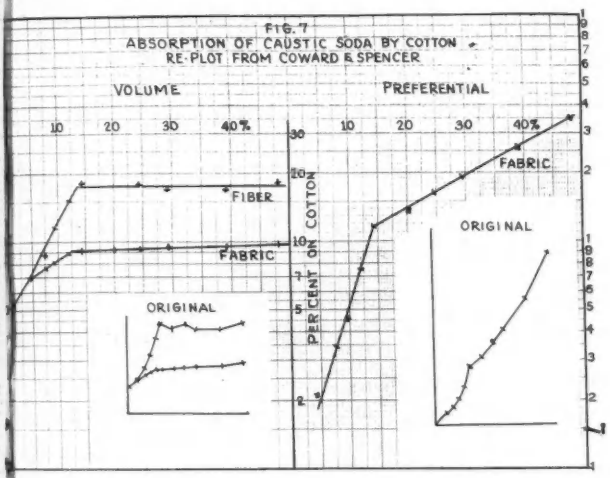
Finally in Fig. 9, is shown the result from plotting some of the author's own data, the tensions developed during the mercerization of skeins of yarn under special conditions. The skeins were 240 yards of 40/2 of ordinary mercerizing twist, wound on the usual 54 inch reel. The loads stretched them at the most to about one per cent gain in length. Caustic containing a wetting agent was applied to the dry yarn at about 75° F.

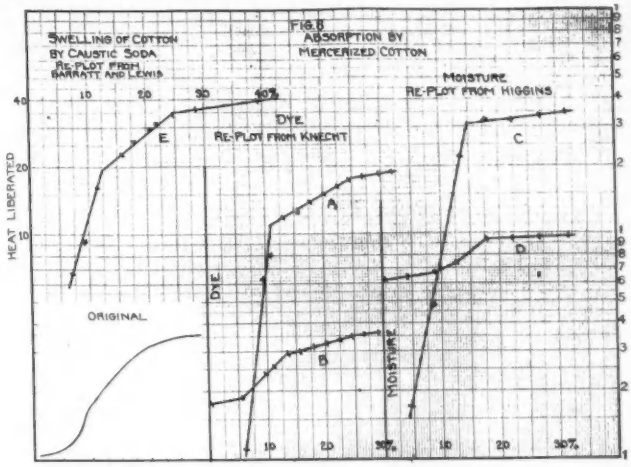
To make an experiment a skein of yarn was loaded with some given weight and mercerized at the corresponding caustic strength so that there was neither stretch nor shrinkage, an arrangement which is obtained rather easily. The yarn is at a slightly different length at each different tension, and when wet with the caustic it will stretch if the caustic is slightly weak or shrink if it is a little too strong. The shrinking force is enough at high concentrations to actually lift 60 lbs. when set up in a balance type of machine.

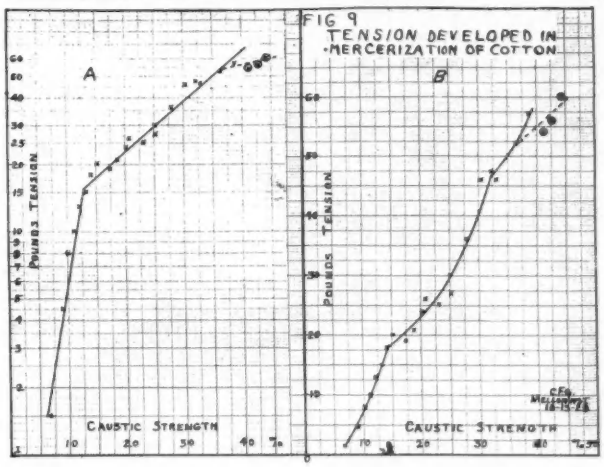
Apparently, after some initial tension is reached which is high enough to "close up" the yarn, the succeeding tensions developed are some sort of measure of swelling tendency. The increase proceeds regularly up to about 13 per cent caustic strength, then at another rate to about 40 per cent concentration. Beyond that point the observations are doubtful due to slow wetting of the yarn by caustic and trouble from the yarn breaking.

*The sharp intersection in the curve for the "Ordinary Method of Plotting" is probably correct but was drawn inadvertently and is not justified by the original data.









The observed points seem to fit the curves on semi-logarithm paper just as well as on the ordinary coordinate paper. The curves intersect at a different value on the semi-logarithm paper and this point is probably the more correct. This curve is also quite similar to the others shown.

The curve from these new data clearly represent a continuing process with one pronounced change. Whatever may be said in the literature about maximum or constant swelling, or about a maximum or constant amount of absorption of caustic at some moderate caustic concentration or range of concentrations, there is obviously some fundamental effect which is independent of them.

Cotton cuticle or yarn twist do not set any limits here although they may influence the results.

Whether or not one wishes to accept the semi-logarithmic plotting as a valid method for the study and interpretation of such processes as are under discussion it seems that there are far too many similarities in the reworked data to be mere coincidence. Parallel lines when drawn on the same basis represent equal rates of change, and many of these lines do have similar slopes.

Since there are both water and caustic involved in swelling it seems quite possible that in the cases where the results follow the compound interest type of law we are getting down nearer to the true effects of the caustic soda, uninfluenced by the effects of water, than in some of the other researches whose results do not follow this law so well.

The obvious conclusion is that caustic affects the cotton, under the proper conditions, in such a way that the amount of change at any concentration corresponds to an increase in volume* from the original (possibly) or from any intermediate stage, at a constant rate which applies to the new volume as it becomes developed. There is apparently a more rapid increase in volume, or swelling, or swelling force below 13 per cent concentration than there is above that strength of caustic.

The turning points of this and the other curves probably depend upon temperature and perhaps other factors, so they can hardly be exactly the same in all the researches.

*Volume is a convenient term but probably not correct. The change is an increase in something, apparently due mainly to the caustic itself—absorption, internal surface, swelling force, activation are all suggestive. An essential part of the problem is to determine what it is.

A complete new study of the various properties of cotton mercerized loose, and of the swelling process, along the lines suggested here, all made on the same cotton and in such a way that the results would all be comparable, would probably assist greatly in an analysis of the complete mechanism of the swelling of cotton in caustic soda. In a very extensive reading on this general subject the author does not remember ever having seen any results presented as semi-logarithm charts.

Numerous data have also been tried on true logarithm paper and occasional straight lines are obtained. Such lines represent adsorption or something which follows a similar distribution law and they may also be useful in such a study as proposed above. Sufficient reworked data are on hand for another paper but there is no opportunity for the large amount of experimental work which should be done in order to develop this subject completely. Unfortunately, there seems to be no obvious direct application to practical mercerizing as now performed.

The author's thanks are due to Mr. E. R. McLean for help in preparing Part I for presentation.

REFERENCES

Bancroft, W. D., Textile Research, *4*, 125 (1934).
Rassow and Wadewitz, Z. Prakt. Chem., *106*, 269 (1923).
Coward and Spencer, J. Textile Inst., *14*, T37 and T40 (1923).
Barratt and Lewis, J. Textile Inst., *13*, T113 (1922).
Knecht, E., J. Soc. Dyers and Colourists 1908, page 68.
Higgins, J. Soc. Chem. Ind. 1909, page 188.

PART II

CHARLES F. GOLDTHWAIT* and EARL R. McLEAN*

4. EFFECT OF TEMPERATURE ON THE RETENTION OF WATER BY COTTON

TO illustrate the simple type of experiment which may lead to interesting and perhaps useful results we can take some determinations of the water retained by yarn upon draining. It was found that different ordinary yarns not only drained to very different amounts of residual water but that a given yarn drained to very different amounts at different temperatures.

Obviously the amount of water which does not drain readily from a mass of goods in a tank or machine will affect such things as the concentration of the next solution, the ease of washing out residual chemicals, and the gross weight of material which must be lifted or transported, etc.

In the typical cases shown in Figure 10 the variations in the water retained run from one to three times the weight of the yarn itself (See Table II.).

These were about as simple experiments as could be made. Small skeins were boiled in water for twenty minutes to secure thorough wetting and removal of readily soluble impurities. Each was then placed in water at the desired temperature for ten minutes, worked constantly, and then lifted full length and drained for one-half minute. This arbitrary time was chosen because all rapid dripping was complete. After weighing, the same skein was put in at the next temperature step and so on through a rising scale of temperatures, and then down again. Any error due to cooling of the draining skeins would make greater differences in water retention than those observed.

The curves show averages for three skeins at each observed point. Each skein was carried up through the changes of temperature and then down. The values agreed so closely in the two directions that the curves were nearly identical and the averages of the values for the two directions have been plotted, so that each point represents six weighings.

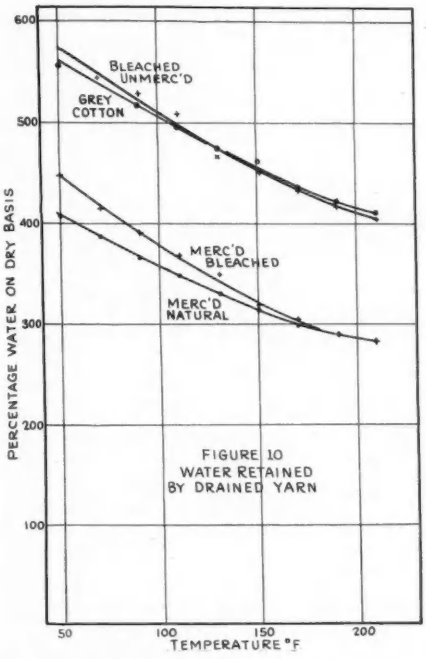


FIGURE 10
WATER RETAINED BY DRAINED YARN

The table shows the results as obtained for a few temperatures in percentages of water based on the weight of dry yarn:

TABLE II

Description of Yarn and Percentage of Water

°F	Mercerized Natural	Mercerized Bleached	Unmercerized Unbleached	Unmercerized Bleached
50	409	368	557	595
90	365	332	517	526
130	331	302	475	462
170	298	280	435	433
210	285	272	410	402

*Industrial Fellows, Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania.

Different yarns may give different values depending upon their structure and previous processing. The results will vary, too, with the form in which the yarn is held. Yarn will undoubtedly drain more completely from a point at the bottom than from a large flat area.

The curve for mercerized natural with water containing one-half per cent Alkanol SA fell slightly below that for the same yarn in water alone. There was not time for any further study of the influence of wetting agents.

The observed results are facts and the same principles undoubtedly apply in various textile processes.

The explanation no doubt depends upon several things. Difference between yarns depends upon compactness and probably upon differences in the cellulose itself.

The change in viscosity of water with temperature may come into the explanation because hot water can flow more rapidly. This was checked by rough tests with water flowing from a pipette at the approximate temperatures indicated:

TABLE III

16 seconds at	48° F.
13 seconds at	120
12 seconds at	180

The time for complete outflow was reduced by heating, by about a fourth, not enough to account for the whole difference in results.

The rate of flow through or from yarn was checked by similar draining experiments and it was found upon comparing yarns lifted from water near the boil without excessive cooling and lifted from water at room temperature that the hot water flowed out but little more rapidly than the cold, not enough to account for the results reported.

Also, surface tension must not be overlooked.

This may all be elementary and well known but, if so, it does not seem to have been studied in any systematic manner and recorded.

Just to show that these general results probably do apply to textiles in bulk, a pound of loose waste yarn of somewhat higher twist than that used above was drained on a perforated board, from water near the boil, and again after cooling to 55° F. The same yarn was also rewet and put through a wringer at similar temperatures. The results are shown below:

TABLE IV

	Temperature	*Water Retained*	*Excess Water*
After Draining	208° F.	231%	..
	55	303	72%
After Wringing	Near boil	101	..
	55	147	46

It follows for these particular experiments that if hot wet yarn is rinsed or cooled by cold water it may carry from half to three-fourths of its weight more water if drained or wrung cold than if handled hot.

Similar tests could be made with a hydro extractor with large enough amounts of goods to prevent too rapid cooling. There is no purpose in accumulating a large mass of data. No doubt some types of stock will carry much more water than this last type of yarn and every sort of material will probably have its own characteristics.

The experiment by wringing suggests that at the lower temperatures the water is held in the cotton in some more intimate manner than by mere entanglement, or reluctance to run out because of greater viscosity. We hesitate to suggest anything very specific about hydration, but the cotton at the lower temperature may be swollen somewhat more and for that reason hold its water more readily.

Incidentally, too, the unmercerized yarn holds much more water than the mercerized, which may be contrary to expectations. Evidently the more compact form of the mercerized yarn more than offsets any gain in "affinity" due to the mercerization.

Nothing has been noticed in the literature about the retention of liquid water by cotton at various temperatures. Experiments on cellophane are on record and show a similar effect to that noted above for wringing cotton. Similar scientific determinations would be difficult, but it is believed that sufficient evidence has been presented to show that they should be made for cotton.

5. EFFECT OF DYE MIXING ON SHADES

This section covers a few experiments which show that the method of mixing direct dyes may have a great influence on the shade produced despite the fact that the kinds and amounts of dyes and the method of dyeing are the same.

For example if a shade is dyed in the laboratory in order to work out a formula it is frequently done by using dyes from solutions at one or more grams per liter. The solutions are mixed, perhaps at the dilution of the dyebath. In the dyehouse the dyes are usually mixed as powders, boiled up together in a very concentrated solution and then put into the dyebath.

In checking up the failure of a formula to repeat, it was found that carefully controlled dyeings made comparatively under these two conditions came out very differently. In one type of experiment the separate dyes were made up at two grams per liter, measured out and mixed; in the other the dye powders were mixed and then dissolved. By each method repeat shades were reasonably similar but very different from those of the other method.

Several formulas, each containing three dyes of altogether different shades, but not selected as likely to be particularly troublesome, were tried, and with equally pronounced results whether the formula came from laboratory or dyehouse.

Of course this suggests that accidental variations in dissolving dyes in the dyehouse may be one cause of compound shades failing to repeat well, which suggests in turn that some best method should be sought. Perhaps it is already available in some commercial product for use when dissolving dyes.

It also suggests that a careful control should be observed in the laboratory and that better results might follow if the method of dissolving dyes when working out shades for the mill were made to conform as closely as possible to that in the dyehouse. It is probably possible also to select dye combinations which will show such differences to a minimum degree.

These observations (and no doubt similar experiences of other members of the Association would do the same) suggested a great deal more research than could be undertaken at the time. Only a few experiments have been made and it is not known whether the effect is general on various kinds of cotton and other cellulose fibers, but it seems more likely an effect of dyes than of fiber.

Such an incomplete story is mentioned here partly with the thought that it may indicate sources of trouble which can be corrected, but primarily, in accordance with the main purpose of this whole paper, because these observations suggest an approach to more fundamental studies on such matters as the aggregation of dyes in solution; the possibility of dye particles made up from more than one kind of dye; and selective dyeing by one or another of the dyes in such a mixed solution. Sometimes relatively simple studies on a complicated system will bring out much new knowledge, and work along this line might contribute something to the final complete explanation of the mechanism of direct dyeing.

—— ♦ ♦ ——

Recent Trends in

Textile Technology*

EDWARD R. SCHWARZ, F.T.I.†

WITH the broadening of the program and purpose of the American Association of Textile Chemists and Colorists to include both chemists, colorists and general textile technologists in its membership and with the growing number of standards and specifications which it is setting up outside the strictly definable field of textile chemistry comes the desirability of an indication of the direction such a course might take.

The trend of textile technology is toward a better understanding of the fundamental properties of textile materials. For many years strength and stretch—neither property too well defined—have been generally accepted as more or less unique and satisfactory measures of the quality of a textile. Probably more effort has been devoted to the perfection of testing machines for the determination of these properties of fiber, yarn and fabric than for all of the other commonly made tests combined. I use the word machine advisedly since, in the past, the equipment has been much more in the nature of a machine than of an instrument of precision. And this was to be expected because all that was wanted was the ultimate tensile strength and stretch. However, now and increasingly in the future we must realize that these end-points in themselves are not only not unique measures of textile quality, but that in addition to being indeterminate in an absolute sense, they are relatively unimportant compared with the multitude of strength-stretch relationships lying below these limits. Already conditions of load at stretches lower than the ultimate—and conversely stretch at loads lower than the ultimate are being specified as necessary and desirable data in the manufacture of rayon and of tire cord. The life of textile materials under stresses far lower than the breaking strength and at stretches lower than the ultimate is now seriously considered. The ability of a material to recover distortion produced by whatever kind of stress or to continue to distort in a fashion dependent upon time is becoming increasingly interesting and important. Thus, elasticity and plasticity must be measured and instruments and techniques adequate to the work must be designed, built, calibrated and operated. The effects of repeated stresses and stretches must be further investigated since it is certainly true that most of the fabrics and yarns in service of every day use fail because of fatigue. They fail because they simply tire out from repeated flexing, rubbing, pulling and pounding. The constant dripping that wore away the stone is very much like the constant flexing that wears out fabric. Yet there is no standard apparatus nor means of test to determine the flexing life of textiles. Some testers have been built with this in mind, but the methods are not adequately treated in the literature, nor are they generally accepted, much less adopted by any recognized body as standard.

Basic to yarn structure is twist. Efforts have been devoted and continue to be devoted to the improvement of twist measuring apparatus, yet the mathematics of twist structure of yarn are incomplete and the devices thus far available commercially are expensive and are inadequate to the complete solution of the experimental problem of twist measurement and control. Even the optical methods are subject to improvement and must be greatly improved

*Presented at Annual Meeting, Philadelphia, Pa., Dec. 4, 1937.

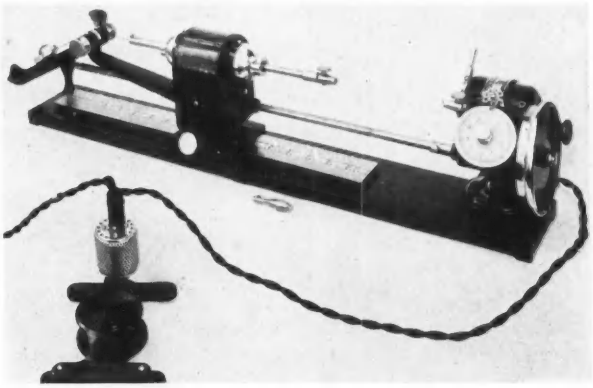
†Professor of Textile Engineering In Charge: Textile Research, M.I.T.

before they can be generally used. Undoubtedly electrical and optical methods will be combined eventually for this sort of measurement.

The change of length in warp and filling yarns due to placement in the body of a fabric and evidenced by what is known as crimp, or take-up is a matter of concern to manufacturer and user of the material alike. One must supply sufficient yarn in the expectation of the shortening due to crimp, while the other must have a fabric so adjusted as to crimp that the stresses applied to it in any direction will tend to be desirably distributed between warp and filling yarns. The flexibility of the cloth is also considerably affected by the difference in crimp in warpwise and fillingwise directions. The difficulty is that according to the present specifications and standard methods of test a mechanical method of analysis must be used which presupposes a tension on the material, sufficient to straighten but not to stretch the yarn. This tension should be determined for each individual case by experiment since the commonly stated rule of dividing 131 by the effective Typp number of the yarn is in many cases subject to errors of several hundred per cent. The answer to the problem may be found by use of the microscope and the determination of waviness which it makes possible. The exact position of the yarns in the cloth can be seen and easily measured without the necessity of tensioning them to an indeterminate degree.

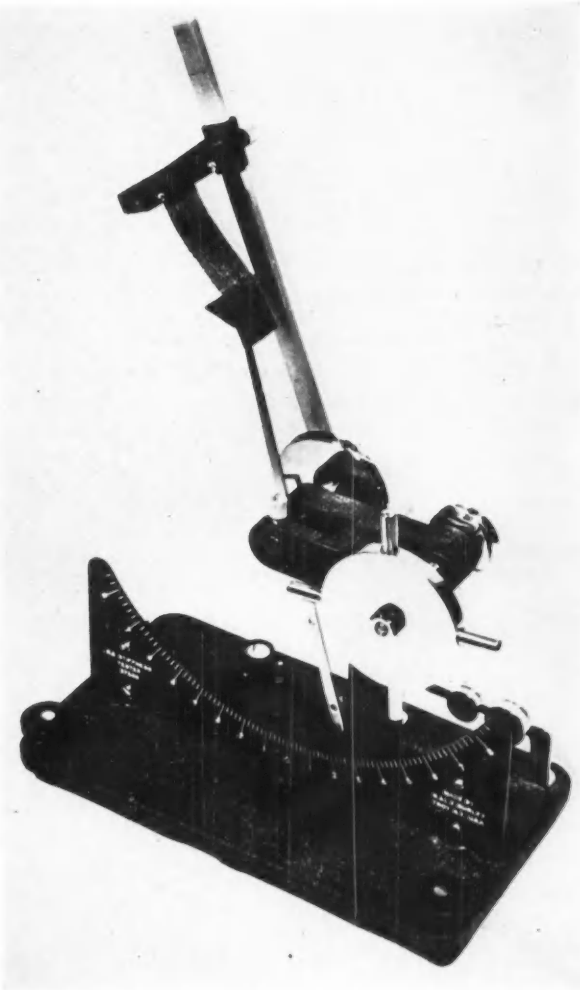
Many other physical tests are accepted as standard and include fastness to light, washing, crocking, shrinkage, and perspiration and such other tests as resistance to tearing, bursting strength, waterproofness, weight, count, fiber strength, wool quality, silk quality, wetting out, etc. But there are even more which are not yet standard—or even proposed as such. I refer among others to the determination of resilience, flexibility, torsional rigidity, permeability to air or other fluids, porosity, heat transfer, abrasion, puncture resistance, and plasticity. These are relatively simple determinations, but to them must be added the investigation of the fundamentals of fiber, yarn and fabric structure, the mechanism of drying, the mechanism of dyeing, the mechanism of moisture absorption.

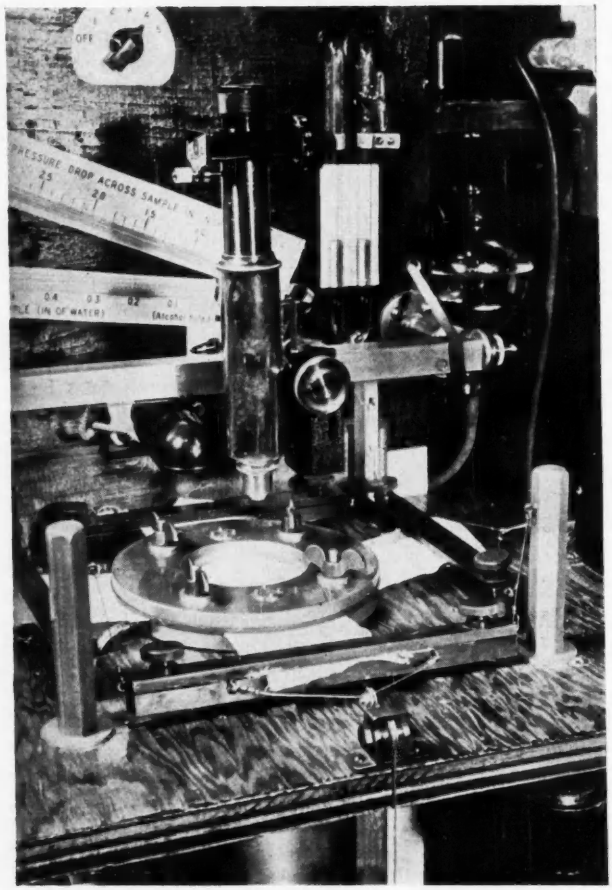
Progress is being made in all these directions by workers in this country and abroad. A certain part of their findings are published. Gradually the importance of such studies is being recognized by the industry and by the ultimate consumer. For instance after centuries of manufacture of spun yarns, the fact that the twist in a single yarn is changed by the action of plying or cabling is appreciated by more laboratory technicians and by more men in the industry than ever before. At least one twist tester is available to make the measurement of the single twist as it exists in the plied yarn more easily possible. Of course it is this twist which affects the strength and stretch of the resulting yarn directly and not the twist in the yarn as it left the spinning frame,—the latter being the twist which is measured by the present technique. So, too,



Above—A twist tester designed for easy determination of single or ply twist as they exist in more complex constructions.

Below—Apparatus for the measurement of the flexibility of fabrics.

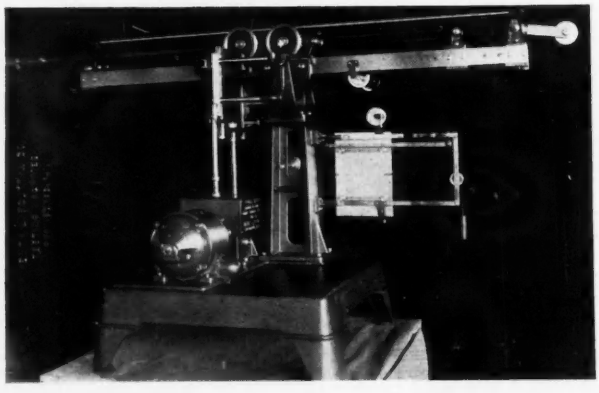




A microscope with a measuring ocular makes possible the obtaining of data as to fabric porosity while permeability measurements are in progress.

the importance of measurement of resistance to wetting or staining is important because of the many sorts of treatment now being applied to yarns and fabric to render them immune from spotting and wetting. In England, Science News Service reports, " . . . models dressed in materials treated to be water repellent spilt tea and lemonade on one another, and calmly shook their skirts while the drop rolled off leaving no mark."

The inclined plane, constant rate of loading machine eliminates certain factors which cause variation in strength determinations with the pendulum type tester.

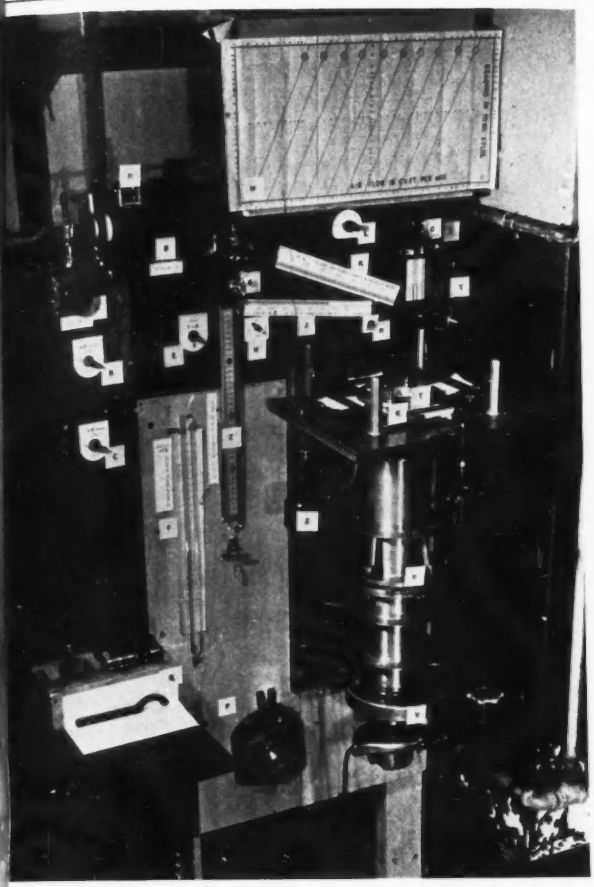


The trend of textile technology is toward a better technique which will take advantage of the newer discoveries in science. The industry has seen a rather widespread adoption of microscopic equipment over the last few years. The full use of this apparatus is not yet generally made. Polarized light offers many possibilities in addition to its use in determining cotton fiber maturity. Ultra violet light and fluorescence phenomena have been used by Mores in research under the auspices of the Textile Foundation which has definite connection with the studies conducted independently by Sisson and by Osborne as Textile Foundation fellows, one in X-ray diffraction studies of fiber structure and the other in the micro analysis of fiber structure. All of this work bears on the studies now under way at Boyce-Thompson Institute for Plant Research and the allied studies at M.I.T., both sponsored by the Chemical Foundation. Dr. Farr and Professor Purves, together with their associates, will without question have many further important contributions to make in the field of cellulose chemistry. The ultra centrifuge is still another instrument of importance in studying such phenomena as moisture absorption for example. Colloid chemistry is developing equipment and methods which will be of tremendous importance in textile research.

The electrical engineer is studying the methods of control of textile finishing machinery so that fabric leaving the machine will contain a uniform and definite amount of moisture. He is also likely to develop some new ideas in the electrostatic spinning of yarn. The present system of drafting is clumsy and productive of variation rather than uniformity. It is probably not a duplication of the actual performance of the hand spinner who fed fibers into the yarn rather than drew out a large mass of fiber into the desired strand. And in studies of processing of textile fibers, many of which are carried out at high speeds, the stroboscope and the technique of ultra-high-speed motion picture photography are essential to intelligent research.

Mills are actually adding spectroscopes to their laboratories to speed up the identification of materials used in the production and finishing of textiles. Such a thing would have been unheard of ten years ago. The recording photoelectric spectrophotometer devised by A. C. Hardy is making possible rational studies of color and dyeing problems which could not be studied at all before, or which were subject to error or were too tedious for routine work.

It is of interest to note that one of the recently awarded Nobel prizes for 1937 went to Professor Haworth of Birmingham University, England. Professor Haworth was studying carbohydrates and his work on the structure of the cellulose molecule was outstanding in this connection. That fundamental discoveries of this character should be developed anywhere but in the textile industry which in so large a measure is dependent upon cellulose for its very existence is evidence of the former total lack of appreciа-

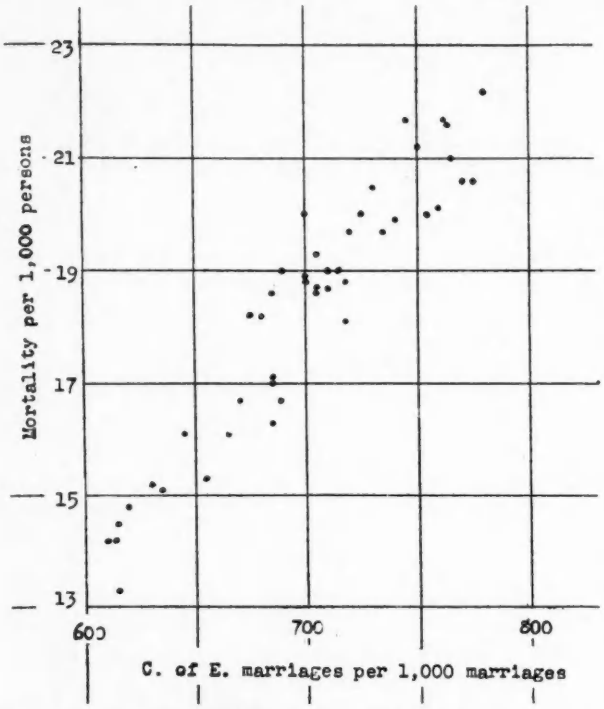


Typical of the devices for measuring properties of textile materials other than simple tensile strength is this apparatus at M.I.T. for determination of the permeability of fabrics to air or water.

tion of fundamental research by the industry. Support of such research is still only fragmentary and wholly inadequate. That this is true is evidenced by the fact that the support for the fundamental research in cellulose chemistry and cotton fiber structure already referred to is being conducted not by the industry directly, but through the Chemical Foundation. No less credit devolves to the Foundation, but certainly the textile industry cannot point with any particular pride to their share in the work which is attracting world wide attention. And science is not through. New discoveries will continue to be made and the textile research worker must take advantage of them or eventually he will bitterly regret his negligence.

The trend of textile technology is toward use of precision methods and the statistical analysis of results. This must be so because of the errors involved in any form of testing. These errors can only be dealt with intelligently by the application of precision studies and by the statistical treatment of the data. Further, the materials themselves are variable and since to be of value many tests must be comparative, the significance of the results must be determined and their degree of correlation worked out. No report of research results in the field of textiles particularly can be considered complete without a precision discussion of method, equipment and results. Not only how much, but how good a measurement is must be reported. Far too many tests are made daily by well intentioned but uninformed workers who obtain results upon which changes of vital concern to their particular branch of the industry will be based. Far too often these results are of no practical significance, and their practical application results in a black eye for research in general, and that partial research in particular. Such methods of analysis are not limited to the laboratory by any means, but should be a part of the quality control program of the mill itself. Some few textile concerns have adopted statistical methods to govern their control of product quality and have achieved interesting success. This is attested to by the fact that representatives of two leading textile manufacturers addressed the class in Statistical Methods for Quality Control inaugurated at M.I.T. last year. The American Society for Testing Materials is beginning to insist upon considerations of precision and upon the statistical treatment of data for its textile work as well as for its other branches of activity and publishes a Manual on Presentation of Data through their Committee E-1 on methods of testing. Problems of sampling still remain unsolved in spite of the work already done in England by the British Textile Institute—which, by the way, has long been noted for the excellent statistical treatment of data in many of

Measurement of heat transmission properties of textile materials becomes possible with a device such as this one developed at the M.I.T. textile laboratory.



A curve put through these points would not, because it is a straight line, indicate a cause and effect relationship between the number of Church of England marriages per 1,000 marriages and the mortality per 1,000 persons, although both vary similarly over a period of years.

its reports. The work undertaken by the Indian Central Cotton Committee is especially noteworthy in this respect.

Too often the laboratory worker in textiles has believed that because when certain data were plotted a smooth curve resulted that therefore there must have been a cause and effect relationship between the factors under investigation. If, for example, the number of deaths per thousand inhabitants of England and Wales is plotted together with the number of Church of England marriages per thousand marriages against time from 1865 to 1910 a smooth curve results and the correlation if figured according to statistical methods is +.95 where +1 is the best possible correlation. Further, if the Quality number of worsted top is plotted against the per cent waste produced by the cylinder of a cotton card a smooth curve results. But by no stretch of the imagination could variation in worsted top quality cause change in the waste produced by a cotton card or vice versa. Plots intended to show a relationship are only justified when from other considerations a real likelihood of cause and effect is suspected or known to exist. A curve is simply a tool, not an end in itself.

Although full advantage of precision measurements and of statistical methods has not yet been taken, the precision of equipment and of observation has so tremendously improved in the course of the last few years that more and more attention is being paid to the variable factors which influence textile tests. For many years the effect of moisture regain upon the strength and stretch of textile materials has been realized and studied. Animal fibered materials and the synthetic fibers of cellulosic and protein bases decrease in strength and increase in stretch as moisture regain increases. On the other hand, vegetable fibered materials decrease in strength and increase in stretch under the same conditions. Thus adequate control of the relative humidity of the air in the laboratory and of the temperature of the laboratory have come to play important parts in textile testing. But not all laboratories are equipped with humidity control and hence test methods which would eliminate the effect of moisture have been devised and used. Thus have arisen the bone dry tests and the tests of soaking wet material. Thus have arisen methods for correcting the strengths of certain classes of yarns and fibers for the effect of moisture on strength. No correction data are generally available, however, which will allow the correction of stretch in this way, nor are data on strength changes available to any great extent except for cotton materials and certain rayons. Even the exact reason for the change in properties is not understood with anything approaching clarity or completeness. Here is a tremendous field for further investigation—and textile technology must turn in this direction at once.

Speeds, rate of loading, and capacities of tensile testing machines are being studied so that we may expect continued improvement in this type of equipment. The time factor in textile testing is of tremendous consequence since all textile fibers are plastic to a marked degree under certain conditions and many of them under any usual condition. The proper selection and preparation of the test specimen itself is of interest since it is a variable which is amenable to easier control than many of the others. Data as to temperature effects are sadly lacking and are of great importance to the finisher and to many a user of textiles. The tire manufacturer is an example of the person to whom such data are vital. The temperatures easily reached in modern balloon tires at high speeds are a matter of concern to the tire manufacturer at this very moment. Too infrequently is the human or personal error considered of importance in setting up data for general use by the industry. A cardinal rule in physics and chemistry research is an independent check of all technique and data before its acceptance. The textile industry accepts far too much information and far too many figures which are based on work by a single observer. Intelligent repetition and intelligent and constructive criticism in this connection are to be considered particularly important and will mark a trend toward better utilization of the results of research. Here again studies of correlation and significance are of utmost importance in order to determine whether the work reported by independent observers is really significantly different or whether there is essential similarity. A fault of much published work in textile research is lack of sufficient detail, clearly enough described

to permit of either intelligent criticism or easy repetition. No one worker can possibly have a sufficient experience and background in the whole textile industry and all its many ramifications to be certain that he has exhausted the possibilities of his particular research. Some one else with a slightly different background or of broader experience and capable of competent judgment should pass upon the work—or better, several such people should follow it up carefully.

The benefit of a critical study of the literature is therefore apparent. A very definite trend in textile technology in the last few years has been to a careful study of the printed work of previous investigators in the same or allied fields of investigation and the inclusion in papers and published material in general of well arranged references to a comprehensive bibliography. The American Association of Textile Chemists and Colorists is to be commended upon having a committee whose function it is to periodically prepare general bibliographies, and upon the increasing excellence of the bibliographical research evidenced in the papers appearing from the pens of its members.

The trend of textile technology is toward intelligent interpretation of the results of research conducted for the benefit of the textile industry and of the ultimate consumer. A necessary preparation for such interpretation is a clear and generally accepted nomenclature made up of carefully defined terms. Sloppy use of terms is a sign of sloppy thinking and this cannot be tolerated in any sort of scientific work. Clear thinking and straightforward formulation of hypotheses and theories is essential and should be a matter of course to the textile technologist. For he it is who must bridge the gap between the scientist on one hand with his scientific phraseology and the textile manufacturer on the other with his peculiar language of the industry. Just as would be the case with foreign languages, the written and spoken words of either are meaningless without an interpreter. The physicist and chemist have their protons, photons, electrons, plastic hysteresis, and so forth. The mill man talks familiarly of cops, slashers, beams, crabbing, slubs, cards, flock, cones, caps, mules, gigs, kettles or harnesses and in none of these instances does the word have its usual meaning to the layman, much less to the scientist. Much work of value to the manufacturer is lost in the obscurity of scientific verbiage. Take for example the familiar process of sorting wool or of grading cotton. Either of these operations, or that of determining the handle of cloth, depends largely on the sense of touch. Scientific investigation of the sense of touch, therefore, should be far from uninteresting to the mill man. But when the scientific work is described clearly and correctly to the fellow scientist it is unintelligible to the textile man. For instance recent work on the sense of touch according to "Science" reads as follows—"The stimuli which have been found to block the alpha rhythm of the electroencephalogram show a superficial correspondence to those which produce electrical or 'psychogalvanic' response of the skin, i.e., various sensory stimuli, 'ideational processes' and startling or emotionally toned situations of almost any type. It is therefore of interest to know whether the alpha block and the skin response are consistently correlated. This is of especial interest, since there has been some evidence that the alpha waves are not only of cortical origin, but may be related to the activity of subcortical nuclei which are more directly involved in emotional response, and since the 'psychogalvanic response' has been shown to be essentially sympathetic and also to respond to a center in the periventricular gray of the third ventricle."

All this to determine what relationship there may be between stimulation of the skin by the sense of touch and the reaction of the brain. In other words—why do we sense things which feel different as different? Why can a skilled cotton classer determine the "character" of cotton by his visual and tactile senses? Why can a buyer judge quality by the "feel" of the fabric?

Again, Morey in a report to the Textile Foundation states certain findings in scientific terms and then translates them into more popular form. His original wording runs like this:

"If dye molecules attach themselves to the underlying fiber structure in a definite single-valued manner, we have at once a means of studying the structure. . . . There are a number of indications that, for certain dyes, the attachment of dye molecule to micelle is directionally single-valued. These indications, dealing with anisotropic forces of the Van der Waals' type result in dichroic phenomena."

Translated this becomes:

"The manner of attachment of a dye molecule to the ultimate fiber structure may be illustrated by means of an ordinary electric light bulb and its socket. The bulb may be attached to the socket only in a definite manner which preserves for any position of the socket the same relative arrangement of the parts. We may deduce the arrangement in space of a number of sockets in a room, even though they were not directly visible, by looking at the luminous bulbs. By properly dyeing the fibers we figuratively attach to the structural units (the micelles) little light bulbs (fluorescent dye molecules) which indicate the micellar positions. A union of micelle and dye molecule which could occur with different relative positions of the two would not permit the application of this method."

It must be emphasized that because the trend of textile technology is definitely toward fundamental research, it does not follow that definite results of great value from a money saving or development standpoint can be expected immediately. If the practical results of an investigation can be predicted and planned on in advance, the work ceases at that moment to be research and becomes an applied science development. Such application continues and is important; but it is dependent upon fundamental research for its very existence and is more than likely to be a by-product of such studies. Many vital discoveries have not been sought specifically but have resulted from

a study of the results of pure science research. As Dr. Bush, Vice President of M.I.T. has said, "The key to accomplishment is research. It need not be complex, in order to be useful, but it certainly should be intelligent." If the trends of textile technology are as I have indicated then the trend of the efforts of those supporting such developments and of those directing them or engaged in them should be in the direction of greater intelligence of planning and execution and, above all, of interpretation of results.

" 'Tis thus at the roaring Loom of Time
I ply,
And weave for God the Garment thou
seest Him by."

—Carlyle

MEETING, PHILADELPHIA SECTION

THE regular meeting of the Philadelphia Section was held at the Penn Athletic Club on Friday, January 14, 1938. Dr. William A. Stericker, development chemist of the Philadelphia Quartz Company, presented an excellent talk on the subject of "Some Uses of Sodium Silicates in the Textile Industry."

Mr. Joseph I. Wexlin, Philadelphia manager of Bausch & Lomb Optical Company, also spoke, using as his subject "A Demonstration with Polarized Light and Discussion of Its Uses in the Textile Industry," illustrated by moving pictures.

The usual informal dinner, at which sixty-five were present, preceded the meeting, while ninety attended the meeting.

The next meeting will be held at the Penn Athletic Club, on Friday, March 4th.

Respectfully submitted,

JAS. P. CONAWAY, *Assistant Secretary.*

COLOR COUNCIL MEETING

MEMBERS of the A.A.T.C.C. are invited to attend the seventh annual meeting of the Inter-Society Color Council to be held February 24, 1938 at the Electrical Testing Laboratories, 80th Street and East End Ave., New York, N. Y. This meeting will take place on the day before the Optical Society meeting at Columbia University, the morning to be devoted to the business of the meeting, the afternoon to technical papers, and the evening to a popular session to which non-members and non-delegates of the Council are invited. The afternoon and evening sessions are jointly sponsored by the Inter-Society Color Council and the Optical Society. Admission to the evening session is by ticket only. Members of the A.A.T.C.C. may obtain tickets from Dorothy Nickerson, Secretary, Inter-Society Color Council, Bureau of Agricultural Economics, Washington, D. C. Requests should be sent before February 20th.

APPLICANTS FOR MEMBERSHIP

Associate

Edward A. Barnett—Treasurer, John Campbell & Co., New York, N. Y. Sponsors: Geo. Lommel, A. W. Edwards.

Elwyn Burton Clancy—Asst. District Manager, Anheuser-Busch, Inc., Cambridge, Mass. Sponsor: T. R. Harris.

Reynolds Caldwell Cochrane—Salesman, duPont Co., R. & H. Chem. Dept., Atlanta, Ga.

John Henry Faunce—American Rolling Mill Co., Middletown, Ohio.

Geo. Edgar Fleming—Salesman, Commonwealth Color & Chem. Co., Philadelphia, Pa.

George O. Lines—Manager, Market Development Division, Commercial Solvents Corp., Terre Haute, Ind.

Mario R. Pesce—Textile Chemist, Wilson Sporting Goods Co., Chicago, Ill.

William H. Randolph—Sales Manager, Southeast, A. E. Staley Mfg. Co., Avondale Estates, Ga.

James S. Reisinger—Salesman, Kelco Co., New York, N. Y.

Herbert S. Schenker—Textile Consultant, Consumers' Testing Laboratories, Philadelphia, Pa.

John F. Smith—Sales Manager, Industrial Division, Iowa Soap Co., Camden, N. J.

Charles Grattan Stover—Manager, Mill Starch Division, Corn Products Sales Co., Atlanta, Ga.

Paul Guy Wear—Southern Sales Manager, Penick & Ford, Atlanta, Ga.

Daniel Reid Weedon—Vice President and Sales Manager, Sayles Finishing Plants, Inc., Saylesville, R. I.

John G. Wick—Salesman, Carbic Color & Chem. Co., New York, N. Y.

Student

Charles J. Dulin—North Carolina State College. Sponsor: A. H. Grimshaw.

Samuel Gilbert Kaplan—Lowell Textile Institute. Sponsor, L. A. Olney.

Herbert S. Page—Lowell Textile Institute. Sponsor: L. A. Olney.

Arnold Ramalho—New Bedford Textile School. Sponsor: F. E. Busby.

CALENDAR OF COMING EVENTS

Meeting, Philadelphia Section, Penn A. C., Philadelphia, Pa., March 4, 1938.

Annual Meeting and Convention, Atlanta, Ga., December 2 and 3.

Washington News Letter

(Concluded from page 60)

and coated fabrics. Both contain the same ingredients. Both products consist of cotton treated with a pyroxylin base. The difference is due to departures in the mode or manner of application of the respective protective coatings.

In approved practice there are added to the nitrocellulose of the pyroxylin base, a solvent for the nitrocellulose to facilitate the flowing of the base onto the cotton cloth, a plasticiser which helps to give softness and flexibility to the treated fabric, and a pigment or dye to give the desired color. Incidentally, it may be noted that the construction, or thread count of the base cloth used for impregnated fabrics differs somewhat from that of coated fabrics.

The appearance-factor, which, of course, has direct relationship with color, also weighed in the substitution of materials which has taken place at the Government Printing Office. It was found that by the perfected process the newly-favored material has the appearance of starch-filled fabrics. This is attained by forcing the pyroxylin base between the threads of the base cloth, an action which tends not only to anchor the pyroxylin compound in the cotton goods but also to permit the texture of the base cloth to show distinctly.

In purchasing pyroxylin-impregnated fabrics for use at the Government bindery, suppliers are required to submit samples one foot square to show colors, patterns and finishes; and one yard, full-width samples to show color, color-fastness and quality. All five sets of specifications provide that the finish must be washable with water and that the color must not crack off when rubbed with a wet or dry cloth.

TRADE NOTES • NEW PRODUCTS

• AMALGAMATED DYESTUFF & CHEMICAL WORKS, INC.

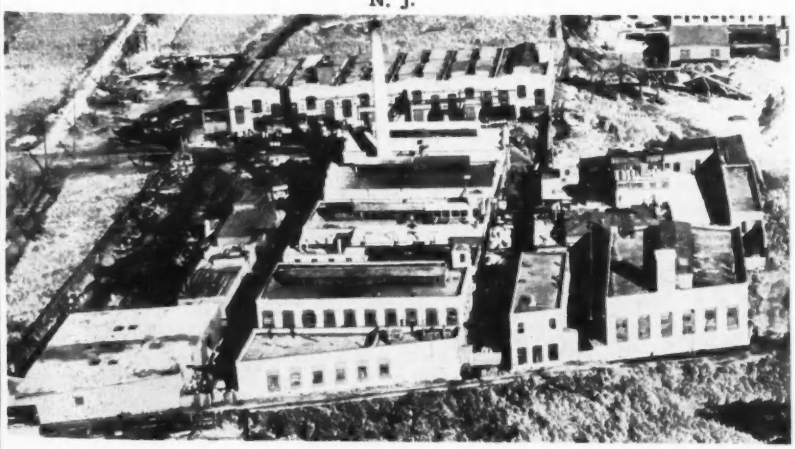
Mr. J. Pfister, the new president and general manager of Amalgamated Dyestuff & Chemical Works, Inc., announces that this company plans the addition of a line of vat colors and naphthols which will be of particular interest to the textile trade. This will supplement the company's already extensive line of acid, basic, chrome, direct, developed and sulfur colors. It is stated that this company has pioneered in the research of acetate rayon dyes and always has had one of the most extensive lines of these dyes in the country.

The new president was recently with the Calco Chemical Co., Bound Brook, N. J., and Providence, R. I., and was previously owner of Wetterwald & Pfister. Under his guidance it is planned to extend as quickly as possible the research and production programs of the company, and the trade will be informed from time to time of the progress made.

John Campbell & Co., 75 Hudson Street, New York City, selling agents of Amalgamated's products since the plant's inception in 1915, will continue to sell their products as heretofore. Amalgamated, however, because it has unusually good facilities for the production of Vat Colors and Naphthols, and a personnel especially trained in their application, will distribute these products direct through its own sales organization with headquarters in the Western Union Building, 60 Hudson Street (corner of Worth and Hudson Streets), New York City.

The plant of Amalgamated is located at Plum Point, Newark, N. J., and it is one of the oldest dyestuffs plants in the United States. The photo shown below will suggest the scope of the plant facilities.

Plant of Amalgamated Dyestuff and Chemical Works, Inc., at Plum Point, Newark, N. J.



• GEIGY RELEASES

Geigy Company, Inc., 89 Barclay Street, New York, N. Y., has released the following color cards:

Acid and Erio Chrome Colors for Carpet Yarn—this card should be of real practical assistance to the user because of the fact that particular attention was paid to the arranging of the dyeings so that shade may be judged from the surface of the yarn as well as through the cross-cut. Another desirable feature of this card is the fact that, unlike many other cards for this field, it is not bulky and therefore is a genuine convenience to the user. Among the colors shown are: (1) a selection of acid colors that are said to possess excellent fastness to light and to be very level dyeing; this selection of colors is especially recommended by the manufacturers for securing light and medium shades; (2) acid colors for darker shades; due to their good yield they are said to possess excellent money value; with few exceptions these colors can be classified as level dyeing; (3) combinations; (4) a group of chrome colors selected from the Erio Chrome colors that are said to possess the all-around good fastness properties demanded by the carpet trade. Card No. 285-D.

Erio Chrome Colors on Woolen Piece Goods—this card displays Erio colors in four depths of shade and divided according to the process by which they are dyed, namely: top chrome method; meta chrome method; bottom chrome method. In compiling this card Geigy has endeavored to include a complete range of this particular group of colors and yet present a card whose simplicity of handling would be a real value to the user. Card No. 939.

• NEW COLOR FASTNESS IDENTIFICATION

In a joint statement released on January 31st at the opening of the Annual Convention of the National Retail Dry Goods Association, the Better Fabrics Testing Bureau of the National Retail Dry Goods Association and E. I. du Pont de Nemours & Co., Inc., announced a new program of color fastness identification for textiles.

The program includes a new seal of color fastness to be known as the "Color Tested" seal which may be affixed to fabrics which pass standard color fastness tests of the Association's Official Laboratory, Better Fabrics Testing Bureau.

The sponsors made clear that the "Color Tested" seal does not indicate absolute color fastness. Rather, the plan is based upon fastness tests in keeping with the use to which the consumer will put the finished article. For example, wash fabrics will be thoroughly tested for color fastness to laundering and to reasonable exposure to light. Drapery fabrics will be tested for cleanability and prolonged exposure to light. Apparel will be tested for fastness to washing or dry cleaning according to the nature of the fabric, and for color fastness to perspiration, rubbing, etc.

Although no fabrics bearing the seal are now on the market, it is expected that leading manufacturers will shortly adopt the "Color Tested" seal to identify fast color fabrics. Early efforts will probably be confined largely to decorative fabrics.

The sponsors emphasized that color fastness in fabrics is a quality that can be determined only by laboratory test and that the "Color Tested" movement is an effort to provide the industry with a universally recognized symbol of satisfactory color fastness for consumer service.

It is expected that the "Color Tested" seal will assist retailers in their efforts to give the consumer complete factual information on the things she buys and at the same time enable store buyers to select the best merchandise for their stores.

The du Pont Company has cooperated in the development of the new seal by supplying the Bureau with necessary technical data and will further assist by endeavoring to familiarize the industry and the consuming public with the "Color Tested" seal and its meaning.

The use of the "Color Tested" seal will in no way depend on type or make of dyestuffs used. The du Pont Company's interest as a leading American manufacturer of dyestuffs is simply to give the textile industry and the consuming public a positive measure of color fastness.

• JOINS BERKELEY PRODUCTS

Mr. H. E. Bishop, formerly executive secretary of the Throwsters Research Institute, announced recently that he has become affiliated with the Berkeley Products, Inc., as vice-president in charge of sales. In view of the fact that Berkeley Products, Inc., has been active in research in the preparatory fields of the silk and rayon industry during the last few years and as Mr. Bishop has been interested in research for some time, this move was not altogether unexpected by his friends.

The business of the Berkeley Products, Inc., is largely the manufacturing and merchandising of patented products to the silk and rayon throwing, weaving and knitting trades.

• NOPCO BOOKLET

National Oil Products Co., Inc., Harrison, N. J., has recently published a booklet entitled "Nopco Softeners and Wax Finishes." The introduction states in part: "Due to the great variety of cotton fabrics and the many different types of finishes desired, we recognize that it is impossible for Finishers of cotton goods to use a universal softener. . . . Therefore, softener finishes must be made to meet specific demands such as,—maximum softening only, softening with body, a flexible but stiff finish, high luster, a light paste with hot or cold starch, a heavy paste with starch, etc. One or more of these properties can be obtained from any specific softener only when the product has been manufactured under a certain controlled procedure with the proper ingredients." Copies of this booklet are available upon request.

• ANNUAL MEETING, S. C. I.

The Annual Meeting of all sections of the Society of Chemical Industry will be held in Ottawa, Canada, June 20-22, 1938. A full program of events extending over the period June 17 to July 1 has been arranged for the visitors from abroad. The American Section of the Society of Chemical Industry will entertain the members of the parent Society at Niagara Falls, New York, on June 25, 26 and 27. The Committee on Arrangements for the Niagara Falls Visit is as follows:

Franuk J. Tone, Chairman; James G. Vail (Chairman, American Section); Wallace P. Cohoe (Vice Chairman, American Section); C. S. Kimball (Hon. Secretary, American Section); J. W. H. Randall (Hon. Treasurer, American Section); Paul S. Brallier, H. R. Carveth, George Cox, Waldo C. Hovey, William B. Leach, James G. Marshall, R. Lindley Murray, R. R. Ridgway, E. A. Rykenboer, H. Walton Scott, Walter Wallace and Howard P. Wells.

• ROHM & HAAS BOOKLET

Röhm & Haas Co., Inc., 222 West Washington Square, Philadelphia, Pa., has recently published a booklet entitled "Triton W-30." In addition to the product mentioned in the title the booklet contains information on wetting agents and wetting processes in general. It is stated that the information it contains has been collected through several years of research in the Röhm & Haas laboratories. Contents by sub-titles are as follows: Wetting Activity; Fiber Swelling; Viscosity Reduction; Penetration; Draves' Sinking Test; Adsorption and Exhaustion; Wool and Silk Deflocculation; Efficiency as a Detergent; Activity in Hard Water. Copies are available upon request.

• S.O.C.M.A. MEETING

The regular monthly luncheon meeting of the Synthetic Organic Chemical Manufacturers Association of the U. S. was held at the Chemists' Club, New York City, on Wednesday, January 19th. The next meeting will be held on Friday, February 18th.

• BROWN FOLDER

The Brown Instrument Co., Wayne & Roberts Aves., Philadelphia, Pa., has recently published a new folder entitled "Legibility Plus Precision." The folder, printed in 7 colors, reproduces the colored numeral records, exactly as they are printed on the chart of the Brown Potentiometer Pyrometer Recorders. It explains the significance of the Brown (+) Symbol, an exclusive feature, which is a part of each numeral record. Copies (Folder No. 84-9) are available upon request.

• GENERAL RELEASES

General Dyestuff Corp., 435 Hudson St., New York City, announces release of a circular describing the following product:

Fast Orange Salt G G D—a new Fast Color Salt said to yield very fast and very bright orange shades with various naphtols, particularly with Naphtol AS, AS-OL and AS-SW. This salt is recommended by the manufacturers for the print-on style on Naphtol AS Prepare and also for the very good discharge of its combinations with different naphtols. It is further said to be well suited for the resist style under Variamine Blue Salts. Circular I.G. 1391.

• HAVEG BULLETIN

Haveg Corp., Newark, Del., has recently published a bulletin entitled "Standard Cylindrical Tanks, Covers and Outlets." It is stated that this bulletin is noteworthy inasmuch as it gives complete technical data on standardized cylindrical tanks. It is believed that it will be of interest to every plant operating official where chemical corrosion is a factor. Copies are available upon request.

• "DURABOND" FINISHES

"DuraBond" has been registered in the United States and Canada as the new name for "Brosco" Repellent Finishes, products of Scholler Bros., Inc., and Scholler Bros., Ltd.

This change applies to the trade name of the compounds which, it is claimed, are now used on approximately seventy-five per cent of all quality hosiery made today.

The products themselves undergo no change, retaining their ability to be used in varying proportions to meet the requirements for any particular fabric. It is stated that the "finish to fit the fabric" is, as always, available in the same fine compounds, recognized as achievements of thirty years' research.

• 24,000,000 CONTACTS

Apparently as good as the day the test started, a new contact designed for use in the textile industry, on January 2 passed the mark of 24,000,000 separate contacts. The inventor, Robert Hetherington, Sharon Hill, Pa., after examination of the parts, said that the probable life of the contact is in excess of 200,000,000 makes and breaks. The tests are being conducted under service conditions at a rate of 12,000 contacts per hour, operating a 110-volt four ampere solenoid which activates a cloth guider developed by H. W. Butterworth & Sons Company, Philadelphia, manufacturers of textile finishing machinery.

Unusual features of the contact are: the speed at which it will operate, up to 25 times per second; the small movement required, about one-eighth inch and the light pressure necessary, about one ounce.

Recently demonstrated to a group of engineers by the inventor was another contact made on the same principle as the one on test, but a three-phase type which, under a 220-volt, 80-ampere load is said to have neither sparked nor arced. This contact measures 1⅝ x 5", and the contact under test measures 1⅝ x 2½". Both contacts are completely enclosed but are not the mercury, vacuum or oil type.

• S.C.I. MEETING

The American Section of the Society of Chemical Industry will hold a meeting on February 11, 1938, at 8:00 P.M. at The Chemists' Club, 52 East 41st Street, New York City. This is to be held jointly with the American Chemical Society. Mr. James G. Vail will preside over the meeting, at which Mr. William M. Phillips, Engineer of Finishes at the General Motors Corporation, is to present a projectoscope talk entitled "Graphic Presentation of Electroplating Operations." A dinner will be held at the Club, preceding the meeting and starting at 6:15 P.M.

• "LOOKING AHEAD"

In commemoration of its 25th anniversary, the Hercules Powder Co., Wilmington, Del., has issued a booklet entitled "Looking Ahead" which covers in brief outline some of the major accomplishments of Hercules Powder Company during the last 25 years. It is stated that the most important achievement that Hercules has made in this period is the building of its highly trained organization for research, development, production and sales in the chemical industry. The foreword states: "On the threshold of another quarter-century, Hercules continues to put its faith in research—not merely the research of test tubes and little bottles, but the strong, healthy, vigorous research of practical purpose; research that leads to the production of new products, that improves old ones; research that increases efficiency of processes and lowers costs."

Hercules Powder Co. started business on January 1, 1913, as a manufacturer of industrial explosives. During the succeeding years Hercules has kept pace with the remarkable growth in the chemical industry until today it is a widely diversified chemical company, manufacturing many products and serving scores of industries.

The booklet is divided into sections showing Hercules progress in a number of diversified industries. It is profusely illustrated.

• BLICKMAN BULLETIN

S. Blickman, Inc., Weehawken, N. J., has recently published a bulletin entitled "Stainless Steel Equipment," which deals with its use in the dyeing and textile industry. It is number 3 of a series. Among the products discussed in this bulletin are the following: Stainless Steel Dye-Mixing Tanks; Stainless Steel Dye and Chemical Tanks; Stainless Steel Dry Cans; Stainless Steel Factory-Material Handling Trucks. For practically a half century the Blickman organization has been specializing in the fabrication of metals and the designing of equipment to satisfy the exacting requirements of the country's most efficiently conducted industrial institutions. Copies of the above mentioned bulletin are available upon request.

• DYESTUFFS DEVELOPMENT

Dr. G. H. Schuler, assistant director of the Technical Laboratory, Dyestuffs Division, E. I. du Pont de Nemours & Company, was a speaker at the National Association of Dyers and Cleaners Convention at the Hotel Stevens, Chicago, January 17-20. Dr. Schuler's talk was scheduled as a part of the afternoon program on January 19. His subject was "Dyestuffs Development and the Dyer."

As a part of the Allied Trades Exhibit, held in conjunction with the convention, the R. & H. Chemicals Department of the du Pont Company arranged a display of company products entering into the dry cleaning field. A feature of this exhibit was a "puppet show" called "Susie Knows Her Q's," demonstrating steps in dry cleaning, treating garments with a water repellent and similar operations. The moving demonstration ran seven minutes and was presented twice each hour. The manikins appearing in the show were eighteen inches high and manipulated by hand.

A portion of the du Pont exhibition was given over to the introduction of a new type of bag employing "Cellophane" cellulose film for returning dyed and cleaned garments. Three types of these bags were shown: one with a strip of "Cellophane" down the front to permit examination of the garment, one with a transparent "window," and one with an entire "Cellophane" front.

• APPOINTED DISTRIBUTORS

Keasbey & Mattison Co., Ambler, Pa., has announced the appointment of the American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York., N. Y., as exclusive distributors for K & M magnesia carbonate, oxide and calcined magnesia, effective January 1st, 1938.

• DU PONT WINS PATENT

The United States District Court for the District of Columbia has handed down a decision authorizing issuance of a patent to E. I. du Pont de Nemours & Company to cover a new sulfur dye, based upon a joint application of George Barnhart and Herbert A. Lubs.

The new dye is a recent contribution to the manufacture of sulfur colors, termed by one of the inventors as "an art, rather than a science." It is in the form of hard, shiny flakes or grains, and is claimed to be substantially free from defects which have afflicted the sulfur dye industry, such as spontaneous combustion, insolubility, swift deterioration, shifting of shade, dustiness and tendency to be blown through the air, and tendering of the fibers to which it is applied. The invention has met with considerable commercial success, the testimony at the trial showing that the sales by the du Pont Company have already amounted to millions of pounds per year.

The patent application was rejected by the Board of Appeals of the Patent Office, following which the du Pont Company filed a bill in equity in the United States District Court against the Commissioner of Patents to obtain a patent for this invention.

Dr. Miles A. Dahlen, testifying in behalf of the du Pont Company, showed that ordinary sulfur black is extremely dusty, is wafted about on drafts and breezes, and

constituted a fire hazard in the heat generated with rapid oxidation.

Mr. Barnhart, testifying for the du Pont Company, told of the characteristics of the new dye, citing its difference in composition from the powder type, which presents a larger surface to the air.

One of the inventors, Dr. Herbert A. Lubs, testified regarding the research and development of this important invention and described the technical development.

"The sulfur colors are a very unique group of compounds in that they are of unknown composition," he said. "Many other dyestuffs are of definite composition, and their manufacture can be proceeded with along definite lines. But in the sulfur colors each slight variation makes a profound difference, often, in the results.

"Prior to the development of the flakes, we had attained very great advance in the art and the manufacture of sulfur colors by the production of sulfur black of a brightness very much greater, a strength very much greater and a solubility very much greater than most sulfur blacks.

"This material was, however, still in powder form, with all of its consequent disadvantages of firing, flying, and so forth. It occurred to us that if we could overcome those disadvantages, we would have a finer article. Continuing our research further, we developed the exact, definite conditions for the production of these grains."

The testimony of E. A. Feimster, Superintendent of Eagle & Phenix Mills, Columbus, Georgia, and of R. H. Webb, Superintendent of Neisler Mills, Kings Mountain, North Carolina, was introduced to present to the court the practical advantages which the new colors secured to the industry.

Chester H. Biesterfeld and John L. Seymour, of Wilmington, represented the du Pont Company, and R. F. Whitehead, represented the defendant.

• NEW THERMOMETER BULLETIN

The new Thermometer bulletin, 198-1, has just been issued by The Foxboro Company, Foxboro, Mass. A brief story on the value of thermometers is followed by separate descriptions of the thermometers associated with the Foxboro trade mark. The story of each class is complete and continuous. Its appearance, its range characteristics, its thermal system and its special bulbs are all illustrated and described within the limits of four pages. The same plan is followed for other sections of information. Everything is grouped under easily recognizable headings. Copies are available upon request.

• PERKIN MEDAL

The Perkin Medal for 1938 was presented on January 7th to Dr. Frank J. Tone, President of The Carborundum Company, at a joint meeting of the American Section of the Society of Chemical Industry and the American Chemical Society, held at The Chemists' Club, New York City. James G. Vail, Chairman, presided over the meeting. After a talk on the life and accomplishments of the medalist by Dr. Carl G. Schluederberg, the medal was presented to Dr. Tone by Professor Marston T. Bogert. After the presentation Dr. Tone gave his medal address entitled "The Quest for Hard Materials."

• INSTALL WAXING ATTACHMENTS

Gaston County Dyeing Machine Co., Stanley, N. C., has recently made installations of hot waxing attachments on the winders at Superior Yarn Mills, Mount Holly, N. C. and at Threads, Inc., Gastonia, N. C.

• MIXING EQUIPMENT LITERATURE

The Mixing Equipment Co., 1062 Garson Ave., Rochester, N. Y., has recently distributed three pieces of literature describing their equipment. One of these deals with "Lightnin" Laboratory Mixers, another, which is entitled "Plain Mixing Facts for Careful Buyers," is concerned with cutting mixing costs and how it is possible to obtain more for your mixing dollar and the third is entitled the "New 'Bearing Guard Mixer'." Copies of these bulletins are available upon request.

• FOXBORO BULLETIN

The Foxboro Company, Foxboro, Mass., has recently published a Bulletin entitled "Recording Thermometers" which deals with thermometers for every industrial use. Much information concerning recording thermometers and incidental equipment is contained therein. Copies are available upon request.

CLASSIFIED

SALES EXECUTIVE WANTED: Prominent manufacturer requires a sales executive with wide experience promoting the sale of textile processing materials such as textile oils or chemicals to the mills both in New England and the South. Salary open. Confidential. See Mr. Briggs, Hamilton Employment Service, 50 Church Street, New York, N. Y. COrtland 7-2864.

POSITION WANTED: Finishing plant chemist desires responsible position. Expert on vats, napthols and other cotton and rayon dyeing. All types of control work and testing. 26 years' experience on yarn and piece goods. Write Box No. 993, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Dyer of Rayon, Cotton and Acetate piece goods. 14 years' experience on all types of machines. Age 34. Will go anywhere. Write Box No. 105, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

WANTED: Manufacturer of a complete line of textile specialties and sulphonated oils has openings for two high class men with a following among the textile mills, dyers and finishers. This is an opportunity for the right men. Write Box No. 106, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Colorist, Textile Printer, age 30, 5 years experience dyestuff laboratory, ten years as colorist large print shop, knowledge all colors and process, any fabric, modern economical methods, location immaterial. Write Box No. 107, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: DYER—Take complete charge preparation and handling of acetate, rayon, linings, novelties, pure dye, silk and wool, weighted, ribbons, hatbands, garments. Sixteen years experience. Eight years with last employer. Speaks English, German, some Spanish. Low cost production. Creative ability. Ambitious and adaptable. Can handle men. Can give references. Write Box No. 108, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

ssor Mars
ntation Dr
titled "The

CHMENTS
chine Co.
de installa
nts on the
lls, Mount
Inc., Gas

ERATURE
062 Garson
ecently dis
re describ
these deals
Mixers, an
in Mixing
concerned
how it i
our mixing
the "New
es of these
quest.

oro, Mass.,
tin entitled
hich deals
dustrial use.
recording
quipment is
ailable upon

of textile
two high
ills, dyers
ight men.
orter, 440

rinter, age
years as
d process,
on imma
Reporter,

complete
n, linings,
bons, hat
ight years
me Span
itious and
es. Write
40 Fourth

EPORTER